

Additional file 1. Provider profiling questionnaire

GENERAL QUESTIONS

1. What type of hospital is your hospital?

- Academic / University hospital
- Nonacademic hospital

Academic / University Hospital = when your hospital is part of or affiliated to a University. An Academic/University hospital aims not only to deliver high-standard patient care, but also contributes to research and education

2. Is your hospital officially designated as trauma centre?

- No
- Yes
- N/A in our country/region

In some countries, hospitals designated as trauma centres are categorized, for example level 1 or 2 trauma centre. In other countries, these categories do not apply. If you live in a country that does not explicitly designate trauma centres, please select the N/A box.

3. If your hospital is a designated Trauma Centre, what is the designation level?

- Level I
- Level II
- Level III

4. How many Intensive Care Unit (ICU) beds does your hospital have in total (excluding beds that are exclusively the coronary care)?

.....

5. Does your hospital have a dedicated neuro-intensive care?

- No
- Yes

6. Which of the following best describes the model of ICU care at your hospital?

Please select one option only

- Closed ICU: critical care physicians (intensivists) assume primary responsibility for delivery of intensive care for Traumatic Brain Injury (TBI) patients. It is possible here that other specialists (e.g. a neurosurgeon) are consulted for advice when deterioration occurs. However, the intensivist remains responsible
- Open ICU: the admitting surgeon (neurosurgeon / trauma surgeon) assumes primary responsibility for care of TBI patients, including the provision of critical care services. This model of care may include elective consultation of an intensivist
- Mixed: the admitting surgeon (neurosurgeon / trauma surgeon) assumes primary responsibility for care of TBI patients. A certified physician in critical care (intensivists) coordinates the delivery of care

7. What is the number of Traumatic Brain Injury (TBI) patients treated in your Intensive Care Unit (ICU) annually?

1. 2012:
2. 2013:

8. With reference to guidelines for Intensive Care Unit (ICU) management of Traumatic Brain Injury (TBI), does your ICU:

- Not have specific guidelines for management
- Follow the Brain Trauma Foundation Guidelines
- Follow National Guidelines (Please specify:)
- Have institutional guidelines which are broadly based on BTF and/or National Guidelines
- Have separate guidelines which you have developed independently

(if #4 or #5 above, please upload a copy of your guidelines)

QUESTIONS ABOUT ICP MANAGEMENT

ICP monitoring

1. What are indications for ICP monitoring in your hospital?

Please provide us the general clinical practice at your center. This does not have to be the same as stated in the guidelines you use

This question is about indications for ICP monitoring in your center.

Select CONSIDERED NOT IMPORTANT IN DECISION MAKING in factors that are never a reason for ICP monitoring.

Select ONLY IN THE PRESENCE OF OTHER RISK FACTORS if the factor is never solely a reason for ICP monitoring, but it might be a reason in combination with one or more other risk factors. For example: a hospital may perform ICP monitoring in patients with a GCS ≤ 8 without CT abnormalities if there are other risk factors present. Respondents from such a hospital should tick 'only in the presence of other risk factors' after GCS ≤ 8 .

Select GENERAL POLICY when the criteria are, in general, a reason for ICP monitoring in your hospital. When you select GENERAL POLICY this must represent a general consensus among colleagues, rather than individual preference.

Where you are in doubt whether this is the appropriate response to the question, we would recommend, for example, either a verbal discussion or an email exchange with colleagues to check consensus.

	Considered not important in decision making	Only in the presence of other risk factors	General Policy
GCS ≤ 8 and CT abnormalities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GCS ≤ 8 <u>without</u> CT abnormalities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GCS 9-12 with contusion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inability to assess a patient with CT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

abnormalities clinically
(e.g. sedation, surgery
etc.)

Intraventricular haemorrhage

Other, please specify.....

2. What are reasons for NOT monitoring ICP at your Intensive Care Unit (ICU)?

	Never (0-10%)	Rarely (10-30%)	Sometimes (30-70%)	Frequently (70-90%)	Always (90-100%)
Glasgow Coma Scale (GCS) > 8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No radiological signs of raised ICP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Risk of raised ICP considered low	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient considered unsalvageable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coagulopathy (non-drug related)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of anticoagulants or platelet aggregation inhibitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No device available	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not local policy to monitor ICP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
We adhere to a protocol in which treatment is based on imaging and clinical examination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too costly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other, please specify.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The responses to this question should represent, as best as practicable, a general consensus on treatment at your center, rather than individual management preferences or opinions.

3. Is there structural variation between (neuro)surgeons within your hospital with regard to the decision to place an ICP sensor?

- No
- Yes

Structural variation refers to a situation in which one or more of the neurosurgeons are generally more likely to place an ICP sensor than others.

4. When a patient with polytrauma and minor intracranial pathology (which would not otherwise indicate ICP monitoring) requires extracranial surgery which is not life-saving, in the acute phase after trauma, do you:

Select all that apply

- Place an ICP monitor and allow surgery to proceed
- Repeat a CT scan before/after surgery
- Undertake a sedation hold before and/or after surgery
- Postpone surgery if at all possible
- Other, please specify.....

The responses to this question should represent, as best as practicable, a general consensus on treatment at your center, rather than individual management preferences.

5. In polytrauma patients with a Glasgow Coma Scale (GCS) >8 and small but not severe initial CT abnormalities, who require mechanical ventilation for a number of days because of extracranial injuries, we apply ICP monitoring:

- Never
- Only sometimes
- Often
- Always

The responses to this question should represent, as best as practicable, a general consensus on treatment at your center, rather than individual management preferences.

6. What kind of ICP sensors are used in your hospital?

- Parenchymal monitors without optional ventricular drainage
- Ventricular catheters
- Both
- Not applicable since ICP sensors are not used

6b. In case you answered 'both' in the previous question:

If you use parenchymal and ventricular catheters in your hospital, when would you use ventricular/ventricular+ sensor monitors (instead of parenchymal monitoring)?

please rank the top 3 reasons:

1:

2:

3:

- Routine in our department
- Not routine, but enlarged ventricles
- External CSF drainage
- No parenchymal device available
- Low cost
- Other, please specify.....

6c. If you use parenchymal and ventricular catheters in your hospital, when would you use parenchymal monitors (instead of ventricular/ventricular+sensor)?

1:

2:

3:

- Routine in our department
- Not routine, but small ventricles
- Mainly motivated by time of day
- No OR available for placement ventricular catheter
- Failed implantation ventricular catheter
- Other, please specify.....

6d. When deciding to monitor ICP we routinely use additional ventricular CSF drainage:

- No, never or seldom
- As second tier therapy to control ICP
- Only if ventricles are enlarged
- Yes, always initially

6e. If you use a ventricular drain:

During the use of the ventricular drain, is the drain open or closed during the most of the time?

- Ventricular drain is open to drain CSF
 - If this answer option is selected: At what level?
- Ventricular drain is closed mostly and opened intermittently
 - If this answer option is selected: At what pressure is this opened? And for how long?
- Other, please specify.....

Intensive Care Unit (ICU) practice around ICP monitoring

	Never (0-10%)	Rarely (10-30%)	Sometimes (30-70%)	Frequently (70-90%)	Always (90-100%)	N/A, we do not have this technique
7. Are prophylactic antibiotics given prior to ICP monitor insertion?	Ventricular catheter:					
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Parenchymal sensor:					
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Are prophylactic antibiotics continued after ICP monitoring insertion?	Ventricular catheter:					
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Parenchymal sensor					
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Is a	Ventricular catheter:					

coagulation panel assessed prior to insertion of an ICP monitoring device?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Parenchymal sensor					
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. What is considered a minimum platelet count for insertion of a ventricular catheter in your Intensive Care Unit (ICU)?

- >150K
- >100K
- > 80 K
- >50K
- Variable, depends on surgeon
- No minimum
- Other, please specify

11. What is consider the minimum INR for safe placement of a ventricular catheter in your Intensive Care Unit (ICU)?

- <1.4
- <1.3
- <1.2
- Variable, depending on surgeon
- No minimum
- Other, please specify.....

12. Who inserts the catheter/probes for ICP monitoring?

Please provide us the general clinical practice at your center. This does not have to be the same as stated in the guidelines you use

This question is about indications for ICP monitoring in your center.

Select NEVER if the specialism has never inserted ICP monitors in TBI patients.

Select RARELY / EXCEPTIONAL if the specialism CAN insert ICP monitors and does this during exceptional circumstances (e.g. during the night, crisis, overcrowding).

Select GENERAL POLICY when the specialism usually inserts ICP monitors.

Where you are in doubt whether this is the appropriate response to the question, we would recommend, for example, either a verbal discussion or an email exchange with colleagues to check consensus.

	Never	Rarely / Exceptional	General Policy
Neurosurgeon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neurosurgical resident	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intensivist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intensivist resident	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neurointensivist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- | | | | |
|------------------------------------------|--------------------------|--------------------------|--------------------------|
| Non-neurosurgical surgeon | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Physician assistant / nurse practitioner | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other, please specify.... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

13. At what level does your Intensive Care Unit (ICU) zero the ICP catheter?

- Foramen of Monro
- Same level as arterial blood pressure
- Other, please specify.....

14. At what level does your Intensive Care Unit (ICU) zero the transducer for arterial blood pressure (for calculation of CPP)?

- Right atrium
- Level of arterial catheter
- Foramen of Monroe
- Other, please specify.....

15. How is the alignment of the transducer to the chosen reference level checked?

- Not formally checked
- By eye
- Spirit level
- Laser indication
- Other (please specify).....

15b. If the level is formally assessed, is this done:

- At admission
- Once each day
- Once per nursing shift
- More frequently

CPP monitoring

16. Please list the target Cerebral Perfusion Pressure utilized at your facility:

Select all that apply

- > 50 mmHg
- > 60 mmHg
- > 70 mmHg
- Individualized

17. For treating CPP, which types of IV fluids are used to augment intravascular volume?

Select all that apply

- Crystalloids
- Colloids – starches
- Colloids - albumin
- Other combinations

18. Which vasoactive drugs are used to support CPP in patients with Traumatic Brain Injury (TBI)?

Select all that apply

- Vasopressors
- Inotropes
- Other, please specify.....

19. What monitoring devices are used to titrate vasoactive drugs?

Select all that apply

- MAP targets only
- Central venous pressure
- PICCO
- Lidco
- Oesophageal Doppler monitor
- Pulmonary artery catheter
- Others, please specify

Advanced monitoring

20. Which of the following additional techniques are utilized at your Intensive Care Unit (ICU) for neuromonitoring?

Select all that apply

	Never (0-10%)	Rarely (10-30%)	Sometimes (30-70%)	Frequently (70-90%)	Always (90-100%)
Cerebral microdialysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Transcranial Doppler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CBF probes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jugular Venous saturation monitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Near infrared monitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brain tissue oxygenation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other, please specify.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Treatment of severe Traumatic Brain Injury (TBI) patients at the Intensive Care Unit (ICU)

21. At your Intensive Care Unit (ICU), the threshold for medical management of elevated ICP is:

- > 15 mmHg
- >20 mmHg
- >25 mmHg
- Other, please specify.....

22. At your Intensive Care Unit (ICU), the threshold for performing a decompressive craniectomy in patients with diffuse injury is:

- > 15 mmHg
- >20 mmHg
- >25 mmHg
- > 30 mm Hg
- NA. Decompressive craniectomy is (almost) never performed in our hospital

Sedation

23. Please rate the utilization of the following sedatives, neuromuscular blockers, and analgesics as first line therapies for ICU management of Traumatic Brain Injury (TBI) patients with increased ICP:

	Never (0-10%)	Rarely (10-30%)	Sometimes (30-70%)	Frequently (70-90%)	Always (90-100%)
Fentanyl	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Midazolam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Morphine (or other opioids)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Propofol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neuromuscular blocking agents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alfa 2 agonist (clonidine or dexmedetomidine)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barbiturates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other, please specify.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Hyperosmolar therapy (mannitol and/or hypertonic saline

Please provide us the general clinical practice at your center. This does not have to be the same as stated in the guidelines you use

This question is about the use of hyperosmotic therapy in patients with elevated ICP.

Select NEVER in agents that are never used in your center.

Select RARELY / EXCEPTIONAL in agents that can be used but are no general policy.

Select GENERAL POLICY when the agent is, in general, used to treat elevated ICP in your center. When you select GENERAL POLICY this must represent a general consensus among colleagues, rather than individual preference.

Where you are in doubt whether this is the appropriate response to the question, we would recommend, for example, either a verbal discussion or an email exchange with colleagues to check consensus.

	Never	Rarely / Exceptional	General Policy
24. Is mannitol utilized to treat patients with increased ICP in your ICU ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Is hypertonic saline	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

utilized to treat patients with increased ICP in your ICU?

26. Is hypertonic saline administered in conjunction with mannitol?

Mannitol and Hypertonic Saline

	Mannitol	Hypertonic saline
27. How are these agents administered?	<input type="checkbox"/> N/A <input type="checkbox"/> Dose titrated to ICP <input type="checkbox"/> Fixed Bolus dosing <input type="checkbox"/> Standard continuous infusion	<input type="checkbox"/> N/A <input type="checkbox"/> Dose titrated to ICP <input type="checkbox"/> Fixed Bolus dosing <input type="checkbox"/> Standard continuous infusion
28. If administered in fixed bolus doses, how frequently is it given:	<input type="checkbox"/> N/A <input type="checkbox"/> More often than 6 times per day <input type="checkbox"/> 6 times per day (every 4 hours) <input type="checkbox"/> 4 times per day (every 6 hours) <input type="checkbox"/> Less than 4 times per day <input type="checkbox"/> Other, please specify.....	<input type="checkbox"/> N/A <input type="checkbox"/> More often than 6 times per day <input type="checkbox"/> 6 times per day (every 4 hours) <input type="checkbox"/> 4 times per day (every 6 hours) <input type="checkbox"/> Less than 4 times per day <input type="checkbox"/> Other, please specify.....
	If mannitol is administered, is serum osmolarity monitored? <input type="checkbox"/> N/A <input type="checkbox"/> No <input type="checkbox"/> Yes If yes, an upper limit of mOsm/liter	If hypertonic saline is administered as a continuous infusion, is there a serum sodium goal? <input type="checkbox"/> N/A <input type="checkbox"/> No <input type="checkbox"/> Yes If yes, a goal of(mEq/L)

The responses to this question should represent, as best as practicable, a general consensus on treatment at your center, rather than individual management preferences.

Second/third tier therapies for treatment of raised intracranial pressure

The responses to the following questions should represent, as best as practicable, a general consensus on treatment at your center, rather than individual management preferences.

29a. Are the following approaches used to treat refractory intracranial hypertension?

	Never (0-10%)	Rarely (10-30%)	Sometimes (30-70%)	Frequently (70-90%)	Always (90-100%)
Decompressive craniectomy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypothermia (temperature < 36 degrees Celsius)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intensive hyperventilation (PCO2 < 4.0 kPa)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Barbiturates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

29b. If hyperventilation is answered with rarely – always:

When is hyperventilation (PaCO2 < 4,0 kpa) utilized in Traumatic Brain Injury (TBI) patients at the intensive care unit?

	Never (0-10%)	Rarely (10-30%)	Sometimes (30-70%)	Frequently (70-90%)	Always (90-100%)
prophylactic hyperventilation (PaCO2 < 35 mmHg)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To manage intracranial pressure for less than six hours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To manage intracranial pressure for more than six hours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
In cases of imminent herniation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is brain tissue oxygen monitoring (PbtO2) used to measure cerebral oxygenation during hyperventilation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

29c. If hyperventilation is used, what is the target PaCO2 (as second/third tier therapy)?

- <35 mmHg
- <30 mmHg
- <25 mmHg
- Variable, dependent on patient
- Variable, dependent on surgeon/intensivist

29d. If hypothermia is used, what is the target temperature?

- >35°
- 35°
- 33 or 34°
- 32°
- Variable depending on patient
- Variable depending on physician

29e. If barbiturates are used, how is the dose targeted?

Select all that apply

- Continuous EEG monitoring
- Intermittent EEG recording
- Serum levels
- EEG and serum levels
- ICP control
- ICP control and EEG