Attitudes of Anesthesiology Specialists and Residents Toward Hemodynamic Monitoring: A National Survey Study

Demographic Information

1. **How old are you?**

2. **What is your gender? (Female / Male)**

3. **How many years have you been in the field of anesthesiology?**

   a) 0-5

   b) 5-10

   c) 10-20

   d) 20-30

   e) >30

4. **How many operating rooms are available in your hospital?**

   a) <5

   b) 5-10

   c) 10-20

   d) 20-30

   e) 30-40

   f) >40

5. **How would you describe the hospital you work at?**

   a) State hospital

   b) Training and research hospital

   c) University hospital

   d) Private hospital

6. **What is your current job title?**

   a) Assistant Doctor

   b) Specialist Doctor

   c) Faculty Member

Questions

For this study, high-risk surgical patients were defined as adults (≥ 18 years) undergoing surgeries expected to last more than two hours and meeting at least two of the following criteria:

- Presence of functional limitation due to cardiac or respiratory disease.
- Extensive surgery planned for cancer requiring bowel anastomosis.
- Expected acute massive blood loss (> 2 liters) during surgery.
- Age ≥ 65 years with functional impairment in one or more organ systems.
- Septicemia (positive blood cultures or septic focus).
- Open-heart surgery or complex cardiac procedures.
- Acute abdomen (e.g., pancreatitis, perforation, gastrointestinal bleeding).
- Acute kidney injury (creatinine > 2 mg/dL).
- Aortic surgery.
- Extensive malignancy surgery.

1. **How often do you anesthetize high-risk surgical patients in a typical workweek?**

   a) I do not administer or directly supervise anesthesia for these patients

   b) 1-5 times per week

   c) 6-10 times per week

   d) More than 10 times per week

2. **Which hemodynamic monitoring parameters do you routinely use for high-risk surgical patients? (Multiple choices available)**

   a) Non-invasive arterial blood pressure

   b) Invasive arterial blood pressure

   c) Central venous pressure

   d) Cardiac output

   e) Pulmonary capillary wedge pressure

   f) Central venous oxygen saturation (SvO2)

   g) Fluid balance monitoring

   h) Stroke volume variation (SVV), Pulse Pressure Variation (PPV), Systolic Pressure Variation (SPV)

   i) Mixed venous oxygen saturation (ScvO2)

   j) Transesophageal echocardiography

   k) Near-infrared spectroscopy (NIRS)

   l) Oxygen delivery (DO2)

   m) Plethysmographic waveform variability (PVI)

   n) Flow time corrected (FTc) (Esophageal Doppler)

   o) Lactate

   p) P(a-v)CO2

3. **When do you perform hemodynamic monitoring for high-risk surgical patients? (Multiple choices available)**

   a) Before anesthesia induction

   b) After anesthesia induction

   c) During surgery

   d) In the postoperative period

4. Do you monitor cardiac output in high-risk surgical patients?

Yes: Which technique do you use? (Multiple choices available)

a) Swan-Ganz catheter
b) Mostcare Monitor
c) PiCCO Monitor
d) Esophageal Doppler
e) Transesophageal echocardiography
f) Thoracic bioimpedance/bio-reactance
g) Massimo LiDCO Monitor
h) Vigileo Monitor
i) Other

No: What are the main reasons for not routinely monitoring cardiac output? (Multiple choices available)

a) Cardiac output monitoring does not provide additional clinical information
b) I use SvO2 and/or ScVO2 as indirect indicators of cardiac output
c) Available cardiac output monitoring devices are unreliable/have too many limitations
d) Available cardiac output monitoring devices are too invasive
e) Cardiac output monitoring increases my workload
f) Keeping up with and learning new devices is exhausting
g) The hospital does not purchase these devices due to high costs

5. What parameters do you use to determine fluid requirements? (Multiple choices available)

a) Clinical experienc
b) Cardiac output
c) Pulse Pressure Variation (PPV), Systolic Pressure Variation (SPV), Stroke Volume Variation (SVV)
d) Urine output
e) Pulmonary capillary wedge pressure
f) Plethysmographic waveform variability (PVI)
g) Central venous pressure (CVP)
h) Mixed venous oxygen saturation (SvO2)
i) Blood pressure
j) Central venous oxygen saturation (ScvO2)
k) Ultrasound and/or echocardiography
l) Lactate
m) Other blood gas parameters (pH, base excess)
n) P(a-v)CO2
o) Passive leg raising and similar fluid challenge maneuvers

6. How do you routinely assess the adequacy of volume expansion?

a) Decrease in stroke volume variation (SVV)
b) Increase in cardiac output
c) Decrease in plethysmographic waveform variability (PVI)
d) Increase in central venous oxygen saturation (ScvO2)
e) Decrease in pulse pressure variation (PPV) or systolic pressure variation (SPV)
f) Decrease in heart rate
g) Increase in urine output
h) Increase in blood pressure
i) Increase in mixed venous oxygen saturation (SvO2)
j) Decrease in lactate levels
k) Decrease in P(a-v)CO2
l) Decrease in systemic vascular resistance

7. If all options were available, which parameters would you use to determine volume expansion and its adequacy? (Multiple choices allowed)

a) Clinical experience
b) Cardiac output
c) Pulse Pressure Variation (PPV), Systolic Pressure Variation (SPV), Stroke Volume Variation (SVV)
d) Urine output
e) Pulmonary capillary wedge pressure
f) Plethysmographic Waveform Variation (PVI)
g) Central venous pressure
h) Mixed venous O2 saturation (SvO2)
i) Blood pressure
j) Central venous O2 saturation (ScvO2)
k) Transesophageal echocardiography
l) Near-infrared spectroscopy (NIRS)

8. In which types of surgeries do you most frequently manage high-risk patients?

a) General surgery
b) Gastrointestinal and hepatobiliary surgery
c) ENT (Ear, Nose, and Throat) and plastic surgery
d) Neurosurgery
e) Urology
f) Vascular surgery
g) Cardiothoracic surgery
h) Orthopedic and trauma surgery
i) Obstetric and gynecologic surgery
j) Other (please specify)

9. Have you attended any training programs on managing hemodynamic parameters and using hemodynamic monitors?

a) Yes, I have attended one or more training programs
b) No, I have not received training in this area yet

10. What challenges do you face while applying advanced hemodynamic monitoring? (Multiple choices allowed)

a) Concerns about the accuracy and precision of the device
b) Complexity of the device interface
c) Difficulty in using and positioning monitoring equipment
d) Challenges in interpreting device parameters
e) Other (please specify)

11. When faced with an emergency during hemodynamic monitoring, which steps do you most frequently take? (Multiple choices allowed)

a) Implement additional monitoring applications
b) Modify the depth of anesthesia
c) Administer cardiovascular drug therapy
d) Change the patient's position
e) Immediately inform the surgical team
f) Other (please specify)

12. **Non-invasive arterial blood pressure monitoring is sufficient for hemodynamic monitoring of high-risk patients undergoing awake surgery under regional anesthesia.**

    Strongly Agree / Agree / Partially Agree / Disagree / Strongly Disagree

13. **In high-risk patients undergoing awake surgery with regional anesthesia, tracking stroke volume using hemodynamic monitoring devices provides guidance for fluid and vasoactive drug therapy.**

    Strongly Agree / Agree / Partially Agree / Disagree / Strongly Disagree

14. **In awake patients, stroke volume variation (SVV), pulse pressure variation (PPV), or systolic pressure variation (SPV) can be used to assess fluid responsiveness.**

    Strongly Agree / Agree / Partially Agree / Disagree / Strongly Disagree

15. **Hemodynamic monitoring devices can be used for goal-directed therapy in critically ill pediatric patients.**

    Strongly Agree / Agree / Partially Agree / Disagree / Strongly Disagree

16. **Hemodynamic monitors are useful in determining the need for red blood cell transfusion in high-risk patients.**

    Strongly Agree / Agree / Partially Agree / Disagree / Strongly Disagree

17. **Advanced hemodynamic monitoring provides advantages in the management of fluid-overloaded patients.**

    Strongly Agree / Agree / Partially Agree / Disagree / Strongly Disagree

The reference 'Cannesson M, Pestel G, Ricks C, Hoeft A, Perel A. Hemodynamic monitoring and management in patients undergoing high-risk surgery: a survey among North American and European anesthesiologists. *Crit Care*. 2011;15 (4):R197.' was used when preparing the survey questions.