ISSUE 13

PRIME

Perfusion-Related Insights – Management and Evidence

TERUMO

Editorial Letter

It is with immense pleasure that we present the 13th issue of **PRIME — "Perfusion-Related Insights – Management and Evidence"** — a quarterly scientific newsletter that includes review articles, recently published clinical studies, expert opinion, news, latest guidelines, quizzes and conference calendar on cardiopulmonary bypass (CPB) and perfusion strategies.

The current issue brings to you two interesting review articles under its first section, **'Specialty Insights.'** The first article of this section will talk about the recent innovations in CPB and perfusion in paediatric cardiac surgeries during the last decade while the second article will dive deep into the role of blood flow and blood pressure in advanced perfusion techniques.

The second section, **'Journal Talk'** also includes summaries of two recently published clinical studies. The first summary discusses a prospective observational study of patients undergoing elective coronary artery bypass surgery and where the relationship of plasma osmolality changes with the use of a hyperosmolar CPB prime has been evaluated. The second summarizes a retrospective study that has compared the efficacy and safety of conventional and new CPB techniques in paediatric patients who have undergone cardiac surgeries.

The third section, **'Expert Desk',** elaborates on the CPB strategies for the treatment of ascending and arch aortic aneurysm. The fourth section, **'News Corner,'** presents the latest evidence on comprehensive blood-saving strategy during CPB in low-weight infants with congenital heart diseases and on the use of blood lactate as a biomarker to assess end-organ perfusion during CPB. The recommendations of the NATA guidelines on blood management during CPB in neonates and infants has been detailed out in the fifth section, titled **'Practice Pearls.'**

The sixth section, **'Mark Your Calendar',** will update you with the upcoming conferences in the field of cardiovascular medicine and surgery. And finally, get ready to tease your brain through our final section, **'Interactive capsule',** which will test your knowledge on CPB and perfusion.

We hope this newsletter enriches your knowledge with the current practices and research updates in the field of cardiopulmonary bypass and perfusion. Kindly let us know your comments and suggestions to help us improvise based on your feedback.

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PRIME Newsletter invites new authors for their contribution to the perfusion community. If you are interested in volunteering your time writing an article or a topic of your expertise and willingness to share your knowledge with our readers, we certainly encourage you to do so. We invite everyone interested in joining our team, and you can contact us at the email given below. Any amount of time that you can volunteer in adding to our quality of publication will be greatly appreciated. Thank you for your interest in PRIME Newsletter. What are you waiting for?

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Specialty insights

Cardiopulmonary bypass in paediatric patients: Recent advancements

Introduction

The focus of cardiopulmonary bypass (CPB) in paediatric cardiac surgery has now shifted towards reducing the morbidity after getting tremendous success in improving the survival rates. This has led to innovations in the areas of CPB and its monitoring, perfusion and blood transfusion techniques, which will be dealt with in this article.

Innovations in CPB

Oxygenators and pumps – Oxygenator fiber bundles wrapped with an arterial line filter, are used routinely and have proven to be safe. In addition, integrated oxygenator-arterial line filter has provided good clinical outcomes in paediatric cardiac surgeries. Occlusive roller pumps are being extensively used in paediatric CPB. Studies suggest that more pulsatile flow may offer the benefit of preventing cerebral edema, which is found with non-pulsatile or minimal pulsatile flow.

Characteristics of an ideal CPB pump

Low priming volume | Does not need anticoagulation | Easy to set up and operate
Reproducible stroke volume | Devoid of mechanical failures | Electrical control
Absence of haemolysis | Battery back up | Antithrombogenic

Monitoring of CPB

Intraoperative cerebral regional oxygen saturation (rSO_2) has been validated as a valuable parameter for cerebral perfusion as well as for renal perfusion during CPB where somatic rSO_2 can be utilized. The development and availability of near-infrared spectroscopy (NIRS) technology has made the estimation of rSO_2 possible. However, despite the evidence, oxygen delivery (DO_2) and carbon dioxide production (VCO_2), the more advanced parameters than mixed venous oxygen saturation (SvO_2) alone, are not used currently for monitoring CPB as a standard of care.

Parameters to monitor CPB

Cerebral NIRS value **below 45%** and renal NIRS **below 40%** are associated with greater incidence of hospital deaths and prolonged ICU stay respectively.

DO_2 < 260 mL/min/m^2 and VCO_2 > 60 mL/min/m^2 are associated with hyperlactatemia.

Biomarkers of cerebral injury*

Biomarkers of cerebral injury	Description	What does research say?
s100β	Protein detected in CSF, blood, urine, amniotic fluid, saliva, and milk.	Increased in CPB. Needs to be correlated with MRI.

Biomarkers of cerebral injury	Description	What does research say?
NSE	Enzyme detected in CSF and blood, following neuronal injury	Increased in cardiac surgery involving a hypothermic circulatory arrest, normothermic CPB, and associated with neurocognitive deficiency following cardiac surgery.
GFAP	Glial specific protein	Increased in neonates with HIE.

CSF, cerebrospinal fluid; HIE, hypoxic-ischemic encephalopathy; NSE, neuron-specific enolase. GFAP, glial fibrillary acidic protein (GFAP).
* However, further research is needed to determine the clinical significance of these biomarkers.

Advancements in perfusion techniques

Perfusion techniques like deep hypothermic circulatory arrest (DHCA), selective antegrade cerebral perfusion (SACP) and splanchnic perfusion without deep hypothermia offer similar benefit of improving the organ perfusion along with providing neurological protection in CPB of paediatric population.

Problems with blood transfusion and innovations to address it

Currently, there are no clear transfusion guidelines for RBC transfusions due to wide paediatric patient variability and transfusion-associated complications like acute lung injury and immunomodulation. Thrombotic complications add to the dilemma. Thus, there is a need to introduce intraoperative practices to reduce the risks associated with blood transfusion.

Ways to improving the quality of prime, minimizing blood prime and salvaging blood can minimize the risk of haemodilution associated with blood transfusion. In 2004, centrifugal cell washing was used in 60% of congenital heart surgeries and was found to be effective in correcting pH and lowering potassium, lactate, and glucose but it increased cell wall fragility and haemolysis. On the contrary, blood prime ultrafiltration is reported to be devoid of the risk of haemolysis. Also, decreasing the prime volume of the CPB circuit can help avoid excessive haemodilution.

Intraoperative blood salvaging and novel techniques like acute normovolemic haemodilution, retrograde autologous priming, venous autologous priming, zero balance ultrafiltration (ZBUF) or dilution ultrafiltration (DUF) and decrease the frequency of RBC transfusion. These techniques can be modified for paediatric patients as modified ultrafiltration to reduce total body water accumulation, increase mean arterial blood pressure, improve left ventricular systolic function, and improve pulmonary compliance. However, miniaturizing the extracorporeal circuit by physical reduction of the extracorporeal circuit volume is the most crucial area for reducing the need for RBC transfusions.

Conclusion

Though there is continued development in CPB and perfusion techniques in neonatal and infant cardiac surgery, best possible outcomes can be achieved by continuous perfusion monitoring, assessment of the biomarkers, data recording and standardization of perfusion practice.

Reference
Sturmer D, Beaty C, Clingan S, Jenkins E, Peters W, Si MS. Recent innovations in perfusion and cardiopulmonary bypass for neonatal and infant cardiac surgery. *Translational pediatrics.* 2018 Apr;7(2):139.

Flow vs. Pressure – Who plays a superior role in perfusion?

Introduction

Cardiopulmonary bypass (CPB), which is a widely used procedure in cardiac surgery, needs extracorporeal circulation to maintain tissue perfusion. To achieve adequate perfusion factors like blood flow and mean arterial pressure (MAP) or blood pressure need to be regulated with the goal of preventing organ damage – particularly of brain, kidney, and gut — which get affected the most.

Blood flow and perfusion

Adequate blood flow of 1.9 to 3. 1 L/min is necessary to preserve systemic and cerebral oxygenation, avoid acute renal injury and GI complication. Its maintenance is vital, particularly during the rewarming phase, when medullar oxygen consumption is high, to protect the kidney. Again, this blood flow depends on body surface area (BSA), acid-base balance, degree of hypothermia, and the depth of anaesthesia. However, a fixed arterial flow based on BSA may result in hyper-perfusion during hypothermia.

Blood pressure and perfusion

Blood pressure needs to be maintained at an optimum level of 50-80 mg of Hg to avoid organ damage and is dependent on hemoglobin level and temperature. How effectively the organs autoregulate themselves also decides the effect of blood pressure on them. If blood pressure is high, organs like brain and kidney can autoregulate themselves to reduce the requirement of oxygen, a function which is absent in gut. However, blood pressure below the cerebral autoregulation capacity is associated with higher morbidity due to kidney injury. Hence, a high blood pressure has been recommended to prevent cerebral and abdominal organ injury, especially in patients who are at a high risk of embolization.

Role of blood flow and blood pressure in CPB and perfusion

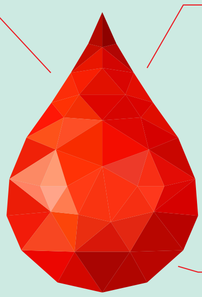
Blood flow

Low blood flow effects

- Myocardial protection
- Clear surgical field
- Less embolic dleivery
- Decreases inflammatory response to extracorporeal circulation

High blood flow effects

- Complement activation after CPB
- Higher micro-embolic load
- Less trauma to red cells
- Post-stenotic turbulent flow



Blood pressure

High blood pressure effects

- Protection of brain and abdominal organs (especially for patients with high risk of embolization)

Low blood pressure effects

- Decrease in renal blood flow

Blood flow vs. blood pressure

The stages that a patient goes during CPB (e.g. rewarming) and the conditions that he is exposed to, highly influence the need of two parameters, blood flow and blood pressure — for adequate perfusion. This is the reason that maintenance level of these two factors varies in different cardiac centers as well as with pulsatile and non-pulsatile flow. MAP was found to have decreased during pulsatile flow vs. non-pulsatile flow, whereas the output fluctuated with centrifugal pump vs. no change with roller pump.

Conclusion

Blood flow and blood pressure are interdependent factors in maintaining perfusion during CPB. Nowadays, with the advent of the data management system (DMS), perfusion scans can be obtained in real-time to determine their adequacy during CPB.

Reference

Pappa MD, Theodosiadis NV, Paliouras D, *et al.* Advanced perfusion techniques–flow versus pressure. ***J Biomed (Syd).*** 2017;2:20-4.

Association of hyperosmolar cardiopulmonary bypass (CPB) prime and plasma osmolality changes in patients undergoing elective coronary bypass surgery

Aim: A prospective observational study determined the magnitude and temporal relationship of plasma osmolality changes related to the use of a hyperosmolar CPB prime in patients undergoing elective coronary artery bypass surgery.

Population / Patient

The study included thirty patients who were scheduled for coronary artery bypass grafting. Patients included had the following characteristics:

- Age group 60-80 years
- Fulfilled the New York Heart Association (NYHA) classification I-III
- Body surface area (BSA) ranged from 1.8-2.5 m^2

Intervention/ Indicator

The CPB priming solution included Ringer's acetate 1000 ml, mannitol 60 g and sodium chloride 360 mmol. The osmolality of this prime amounted to 670 mOsm/kg.

Comparator/ Control

Plasma osmolality was analysed on eight occasions: preoperative, anaesthesia, pre-CPB, start CPB, CPB 30 min, end CPB, post-operative day 1, and post-operative day 2.

Outcome

- The preoperative plasma osmolality decreased from 297±4.0 mOsm/kg to 294±3.9 mOsm/kg ($P=0.002$) on arrival to the operating room and increased to 322±17 mOsm/kg ($P<0.001$) at the beginning of CPB and remained high after 30 minutes (310±4 mOsm/kg) and throughout the procedure (309±4 mOsm/kg)
- The plasma osmolality level returned to normal values (291±5 mOsm/kg) postoperative on day one and remained normal the subsequent day (291±6 mOsm/kg)
- The difference between the measured osmolality and calculated osmolarity was normal (<12±5.3) before CPB initiation; however, the gap increased markedly to more than 40 ($P<0.001$) on CPB initiation
- This osmolar gap remained abnormally high (>25) until the following postoperative day
- Plasma sodium concentration gradually decreased ($P<0.001$) until the end of CPB, followed by an increase to a near preoperative level on the 1st and 2nd post operative days

Conclusion

The hyperosmolar CPB prime shows instant elevation of the plasma osmolality. Such rapid changes in plasma osmolality might be associated with organ dysfunction.

Reference

Malmqvist G, Claesson Lingehall H, Appelblad M, ***et al.*** Cardiopulmonary bypass prime composition: beyond crystalloids versus colloids. ***Perfusion.*** 2019 Mar;34(2):130-135.

Comparison of conventional and new cardiopulmonary bypass (CPB) strategy with a miniaturized tubing system

Aim: This retrospective analysis aimed to compare the effectiveness of conventional and new CPB strategies in children by evaluating the outcomes after congenital heart surgery.

Population / Patient

- The study included 925 patients undergoing congenital heart surgery with cardiopulmonary bypass
- After propensity score matching, there were 610 patients

Intervention/ Indicator

- Before propensity matching, out of 925 patients, 413 patients were included in the new strategy group. After propensity matching, there were 305 patients in the new CPB strategy group
- In the new CPB strategy, the tube used in the CPB system was smaller and shorter than that in the conventional strategy group. The height of the venous reservoir was equal to that of the operating table, and vacuum -assisted venous drainage (VAVD) was used to maintain negative pressure <-20 mm Hg. The automatic alarm level was set at 20 mL. The miniaturized CPB circuit was used without routine, conventional ultrafiltration (UF) or modified ultrafiltration (MUF)

Comparator/ Control

- After propensity matching, there were 512 patients in the conventional strategy group, and after propensity matching, there were 305 patients in the conventional CPB strategy group
- In the conventional CPB strategy, the height of the venous reservoir was 20-30 cm below the operating table, and an ultrafiltrator was routinely installed. The automatic alarm level was set at 50 mL. Conventional UF or MUF was initialised after separation from CPB

Outcome

- For short-term surgical outcomes, patients in the new strategy group had fewer hospital stays (8.2 ± 4.3 vs. 9.1 ± 7.2, p = 0.018) and fewer ICU stays (2.2 ± 1.5 vs. 3.2 ± 4.1, $P < 0.001$) compared with patients in the conventional strategy group
- Successful intraoperative extubation (IE) was achieved in 63.28% of patients in the conventional strategy group and 61.97% patients in the new strategy group
- There were no significant differences between the two groups in terms of extubation ($P = 0.738$), reintubation rates ($P= 0.128$) and NCPAP rates ($P = 0.088$)
- In the stratified analysis according to STAT categories, patients in the new strategy group had significantly fewer hospital stays ($P = 0.046$) and fewer ICU stays ($P < 0.001$) compared with patients in the conventional strategy group when the STAT category was <3
- No significant difference was observed between the two groups in terms of hospital or ICU stays ($P > 0.05$) when the STAT category was ≥3

Conclusion

The new cardiopulmonary bypass strategy with miniaturized cardiopulmonary bypass circuit system was safe and effective for children who underwent congenital heart surgery with fewer hospital and intensive care unit stays.

STAT: The Society of Thoracic Surgeons-European Association for Cardiothoracic Surgery

Reference

Zhang C, Meng B, Wu K, *et al.* Comparison of two cardiopulmonary bypass strategies with a miniaturized tubing system: a propensity score-based analysis. *Perfusion.* 2019 Feb 10:267659118825395.

Expert Desk

Strategies for ascending and arch aortic aneurysm

S. Immanuel, R. Selvakumar, P.V. Prakash and D.P. Shetty

- Initiate CPB with bicaval venous and double arterial cannulation (Axillary and femoral artery with 8 mm graft)
- Monitor arterial blood pressure (ABP) invasively through the right radial and left femoral access
- It is mandatory to monitor NIRS for all cases with arch involved aneurysmal dissection
- Safer deep hypothermic circulatory arrest (DHCA) is lesser than 30 min at 18˚C core temperature
- During DHCA, cerebral reperfusion can be re-established once the NIRS value reaches 20% less than the baseline index
- The neurological outcome is found to be better in DHCA with antegrade cerebral perfusion (ACP) as compared to DHCA without ACP
- ACP flows 10-20% of total cardiac output, which varies with NIRS and right radial pressure 40-50 mmHg
- Additional cannulation may be provided to left common carotid artery (LCCA) if left NIRS is less than the baseline during ACP
- Recommended ACP duration should not exceed 90 min with the temperature difference of nasal (18˚C) and rectal (22˚C)
- Taking into consideration a patient's core temperature, myocardial protection with STS cardioplegia should be repeated after 25-40 minutes
- Once ACP time exceeds 40 minutes, the femoral arterial flow should be re-established, post-introduction of an endoaortic clamp distal to the left subclavian artery
- Antegrade cardioplegia is given post-implantation/repair of the aortic valve with coronary buttons, using modified Foley's catheter in the neo-root (Graft)
- During ACP, the SVC saturation in the perfusate should be adjusted with FiO2 and kept in the range of 70-80%
- Mild hypercapnia (pH-stat) should be employed during cooling for DHCA while, α - stat normocapnia should be employed during the rewarming phase
- Thiopental Na (STAT: 10-15 mg/kg) and propofol infusion (7-10 mg /kg/hr) are routinely used for aortic arch reconstructive procedures
- To decrease intracranial pressure and avoid cerebral hypoperfusion, cerebrospinal fluid (CSF) should be drained
- Tranexamic acid (STAT 10 mg/kg) should be given at an infusion flow of 1 mg/kg/hr.
- Deep Trendelenburg position and bilateral carotid compression with transesophageal echocardiography (TEE) guidance helps in accomplishing effective deairing
- It is important to maintain nasal and rectal temperature during cooling and rewarming, ensuring that the difference in nasal and rectal temperature does not exceed more than 4˚C
- During profound hypothermia, haematocrit (HCT) up to 20% is acceptable but has to be ≥28% to come off the bypass
- During the CPB run, the levels of serum lactate and glucose should be maintained at 4-6 mmol/l and 150-200 mg/dl respectively

Reference

Immanuel S, Selvakumar R, PrakashPV, ***et al.*** Strategies for ascending and arch aortic aneurysm. NH Health City. Unit of Narayan Health.

Evolution of blood-saving strategy for superior outcomes in infants undergoing open heart surgery under CPB

Cardiopulmonary bypass (CPB) plays a crucial role in open-heart surgery. However, neonates and infants undergoing open-heart surgery pose unique challenges in the management of CPB due to their small body surface area and low body weight. Low body weight and blood volume may cause excessive haemodilution, which may lead to complications such as hypoxia, oedema and haemorrhage.

Transfusion of allogeneic blood has been adopted to reduce the excessive haemodilution, but evidence strongly suggests that it may be associated with allergic reactions, high fever, postoperative infections, longer ventilation time and ICU stay due to immature organs and inadequate immune functions in infants. Also, numerous studies have shown that allogenic blood transfusion may aggravate the systemic inflammatory response associated with CPB and directly affect operative outcomes. Hence, major blood-saving techniques such as minimizing the priming volume, controlling the total volume of CPB, and increasing the blood salvaged from the circuit had emerged to improve their safety.

Over the years, a comprehensive blood -saving strategy has been developed, which comprises of mast pumps, oxygenator with arterial filter, vacuum-assisted venous drainage, miniaturized circuit, minimal priming volume, ultrafilter, cell saver, and no-plasma priming. In a randomized prospective study, Wu T *et al*. evaluated this comprehensive blood-saving strategy during CPB on postoperative recovery in 86 low-weight infants (<5 kg) undergoing open-heart surgery. It was found that total priming volume and banked red blood cells were significantly lower in the comprehensive strategy group than the control group (priming volume: 280±11 mL vs. 450±16 mL, *P*=.009; banked RBCs: 110±18 mL vs. 190±24 mL, *P*=.04). After CPB, the amount of salvaged red blood cells exceeded the priming red blood cells by 40±11 mL in the comprehensive strategy group. Also, postoperatively, significant decrease in the inotrope score (*P*=.03), ventilation time (*P*=.03), intensive care unit stay (*P*=.04), and hospital stay (*P*=.03) was observed in the comprehensive strategy group as compared to control group.

Conclusion

Evidence strongly suggests that comprehensive blood-saving strategy during CPB reduces blood product usage and exhibits favorable postoperative recovery in low-weight infants with congenital heart disease undergoing open-heart surgery.

Reference

Wu T, Liu J, Wang Q, *et al.* Superior blood saving effect and postoperative recovery of comprehensive blood-saving strategy in infants undergoing open heart surgery under cardiopulmonary bypass. ***Medicine (Baltimore).*** 2018; 97(27): e11248.

Blood lactate levels as a biological marker of end-organ perfusion quality during CPB

Intraoperative factors may cause vigorous organ hypoperfusion during on-pump cardiac surgery. Peripheral hypoperfusion may occur unsuspectedly despite cardiopulmonary bypass (CPB) use and affect patient outcomes. Blood lactate levels may be used to detect inappropriate tissue perfusion and oxygenation. Though the rise in blood lactate levels during cardiac surgery may be multifactorial, high perioperative levels have been reported to be associated with poor outcomes. Therefore, Duval B *et al.* in a large-scale retrospective study evaluated the association of change in blood lactate levels and overall intensive care unit morbidity and 30-day all-cause mortality in 7,795 patients undergoing on-pump cardiac surgery.

The study showed that a large proportion of patients (65.9%) exhibited an intraoperative change in blood lactate levels between 0.1 and 0.9 mmol/L. A concentration-dependent relationship was found between change in blood lactate levels and intensive care unit morbidity and 30-day mortality. Change in lactate levels (>0) was associated with an increase in overall intensive care unit morbidity. Also, an independent relationship was observed between change in lactate levels and 30-day mortality with the increase of 1 mmol/L.

Conclusion

In conclusion, change in blood lactate levels had an impact on short-term postoperative outcomes in adult patients undergoing cardiac surgery. Hence, intraoperative changes in blood lactate levels should be used as a biological marker of end-organ perfusion quality during CPB.

Reference

Duval B, Besnard T, Mion S, ***et al.*** Intraoperative changes in blood lactate levels are associated with worse short-term outcomes after cardiac surgery with cardiopulmonary bypass. ***Perfusion.*** 2019; 28:267659119855857.

Practice Pearls

Patient blood management for neonates and children undergoing cardiac surgery: 2019 NATA guidelines

Paediatric cardiac surgery is associated with a substantial risk of bleeding, frequently requiring the administration of allogeneic blood products. Patient blood management (PBM) programs are devised to optimise preoperative haemoglobin, limit blood sampling, improve haemostasis, reduce bleeding, correct coagulopathy, and incorporate blood sparing techniques (including restrictive transfusion practices). It is also important to apply these programs to the paediatric population undergoing cardiac surgeries.

Cardiopulmonary bypass (CPB) management strategies such as type of priming, the volume of priming, use of ultrafiltration have been developed to decrease coagulopathy and the bleeding risk related to CPB. The task force from the Network for the Advancement of Patient Blood Management, Haemostasis, and Thrombosis (NATA) provides evidence-based recommendations regarding cardiopulmonary bypass and priming practices for neonates and infants undergoing cardiac surgery.

The 2019 NATA Guidelines recommend the following for cardiopulmonary bypass and priming in neonates and infants

- Use of miniaturized CPB should be implemented for neonates and infants to reduce the effects of haemodilution and the likelihood of transfusion (Grade 1C)
- Red blood cells can be added to maintain a haematocrit > 24% during CPB based on the estimation of the degree of haemodilution related to CPB prime and cardioplegia (Grade 2C)
- Fresh frozen plasma (FFP) can be added to the CPB prime in neonates (< 30 days old) undergoing cardiac surgery with cardiopulmonary bypass (Grade 2C). Due to the absence of evidence, a recommendation regarding the addition of FFP in infants and children cannot be made (C)
- Colloids (e.g., albumin) should be preferred over crystalloids for clear priming in children undergoing cardiac surgery (Grade 1C)
- Conventional ultrafiltration or ≥ 10 min of modified ultrafiltration is recommended for neonates and infants undergoing cardiac surgery with CPB (Grade 1B)

Reference

Faraoni D, Meier J, New HV, *et al*. Patient Blood Management for Neonates and Children undergoing Cardiac Surgery: 2019 NATA guidelines. ***J Cardiothorac Vasc Anesth.*** 2019; pii: S1053-0770(19)30296-4.

Mark your calendar

4th Annual Conference of Society of Minimally Invasive Cardiovascular and Thoracic Surgeons of India

13th-15th September 2019 | Hotel Taj Santacruz, Mumbai

71st Annual Conference of Cardiological Society of India (CSICON 2019)

5th-8th December 2019 | The Ashok Hotel, New Delhi

66th Annual conference of Indian Association of Cardiovascular-Thoracic Surgeons

6th-9th February 2020 | The FORUM Grand 07, Ahmedabad

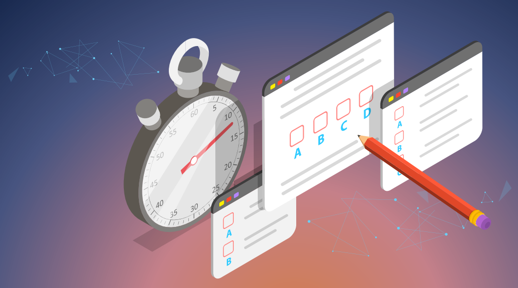
Indian Society of Extracorporeal Technology Annual Scientific Meeting (ISECTCON 2020)

7th-8th February 2020 | Maharaja Shree Agrasen Charitable Trust, Agrasen Foundation, Ahmedabad

Indian Association of Cardiovascular and Thoracic Anaesthesiologists Conference (IACTACON 2020)

7th-9th February 2020 | Hotel Holiday Inn - Cavelossim, Goa

Interactive Capsule



Multiple-choice questions

1. During cardiopulmonary bypass, presence of blood in the pericardial cavity for a significant period before being sucked into the cardiotomy suckers, can lead to:

A) Increased chances of thrombosis

B) Increased chances of bleeding

C) Induction of hypothermia

D) Familial type - Medullary carcinoma thyroid

2. The use of a device in the cardiopulmonary circuit reduces the need for blood transfusion. What is it?

A) Cell saver

B) Roller pump head

C) Centrifugal pump head

D) Hemoconcentrator

3. Applying negative pressure to the venous reservoir achieves a vacuum-assisted venous return, which in turn reduces the need for haemodilution and the use of blood. What is the approximate pressure applied to the venous return?

A) – 20 to – 30 cm water

B) – 40 to – 60 cm water

C) – 70 to – 80 cm water

D) – 90 to – 100 cm water

4. What does double-stage venous cannulation mean?

A) Separate venous cannulae are inserted into superior and inferior vena cavae

B) Superior and inferior vena cavae are cannulated one after the other

C) One venous cannula is inserted that has drainage holes in the superior and inferior vena cavae

D) One venous cannula is inserted that has drainage holes in the right atrium and inferior vena cava

5. In an arterial cannula, the special design of the tip of the arterial cannula has been mainly developed to:

A) Reduce air embolism around the cannula

B) Reduce sheer damage to blood and aortic wall

C) Facilitate easy insertion into the aorta

D) Reduce clotting around the cannula

Reference

Saudi Medical Journal. Multiple choice questions. Available from: https://smj.org.sa/index.php/smj/article/viewFile/7708/5380 Accessed on: July 24, 2019.

Answer: 1 - B, 2 - C, 3 - B, 4 - D, 5- B

Terumo® Advanced Perfusion System 1

Since its introduction in 2002, perfusionists and surgical teams have relied on Terumo System 1 to help deliver the highest quality care and achieve the best possible patient outcomes.

To maintain this standard, Terumo continually invests in the technology and design of Terumo System 1 with a focus on increasing system safety and reliability, and reducing risk.[1]

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Configurability takes form: Terumo® System 1 adapts to evolving practices.

[1] Data on file.

TIPL-014-11-PRI   Date of preparation: August 2019   For the use of a registered medical practitioner or a hospital or a laboratory only

Design and developed by havas life sorento

The author **Xrays Biocom** and the reviewer have, as far as it is possible is taken care to ensure that the information given in this PRIME Newsletter Issue 13 is accurate and up to date:

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