

Permission to print:	Yes
Category	Venous reservoir
Category 2	Staffing
Severity	Good Catch No Harm Incident
Duration of incident:	minutes
Procedure acuity:	Elective
Description:	Elective case for redo sternotomy, debranching aortic arch and frozen elephant trunk. Previous Type A dissection managed with mechanical Bentall's Nov 2025. Anaesthesia unable to get right radial upper limb line. Decision to proceed to bypass in absence of right arm monitoring. General anaesthesia uneventful. [Proceeded] onto bypass with central cannulation, full flows achieved. Poor venous drainage reported to surgeon during cooling - venous line manipulation x2. Requested to use VAVD with the Terumo hardshell venous reservoir (HSVR) when ongoing poor drainage despite returning all retrograde prime volume + 1L crystalloid. - Poor response to VAVD at -10 to -20 cmH2O. - Perfusionist 2 (attending by request of the primary perfusionist) reminded the primary Perfusionist to remove VAVD during any periods of low flow. (Vacuum was controlled by partially occluding the wye tubing in the HSVR vent port and adjustment of the low vacuum regulator - see photo). Cooled to 26 degrees Celsius; patient fibrillated at 30 degrees without LV vent. Perfusionist 2 stepped out of room. Once ready, surgeon asked for flows down to cross-clamp aorta. The primary perfusionist believed they [had] removed the VAVD clamp at that time but may instead have turned down the VAVD low vacuum regulator knob while leaving vacuum on. Aorta cross-clamped; asked to deliver del Nido cardioplegia. Cardioplegia not pressurising and reducing electrical activity as expected. Surgeon planned to re-clamp. The primary Perfusionist clamped cardioplegia line, setting off high pressure alarm so undid the tap returning cardioplegia to venous reservoir. On attempting to deliver second dose of cardioplegia, was simply recirculating del Nido to reservoir and this took time to diagnose with help of surgeon. Began delivering del Nido and was checking the HSVR level (now full) and noted del Nido bag empty and air in cardioplegia line with alarm (entrained when changing CP bags). Surgeon asked for extra help - Perfusionist 2 returned to the room and noted clamp still on VAVD with suction off. Clamp removed. Perfusionist 2 took over as primary perfusionist. Refilled the del Nido cardioplegia line and re-dosed del Nido cardioplegia with appropriate arrest of heart. Ultrafiltration was used to remove excess fluid. After cardioplegia delivery, commenced antegrade cerebral perfusion was via the axillary artery. Noted frothing in venous line after volume drained when placed on cerebral perfusion. While possibly related to suckers running and causing positive pressure during previous period of VAVD it was most likely air entrainment from venous cannula manipulation during VAVD and poor venous drainage. The venous line was refilled by Perfusionist 2. NIRS stable throughout. Case continued without further incident. Patient rewarmed. Off bypass with expected issues for the case: - some RV dysfunction that resolved in immediate post-bypass period and high blood product requirement. Patient returned to ICU and extubated the next day. Discharged from ICU to ward for re-warfarinisation.

GOOD CATCH - what went well In this highly complex case Perfusionist 2 showed excellent skills in resolving issues when called. Being cool at 26 degrees was protective in periods of low flow. Haemofiltration effectively managed haemodilution.

What could we do better The primary perfusionist had full insight into the limitations of their experience in managing this highly complex case. Having recently returned from leave following a significant personal event, they had requested additional case exposure and supervision, but opportunities to obtain this had been limited. They had also indicated to Perfusionist 2 that assistance would be required if they were allocated the case.

Alternative proprietary systems are available that prevent application of vacuum when the venous reservoir is clamped; however, the unit is not currently planning to upgrade the system.

Preventive actions The staffing concerns were escalated immediately to senior staff, and arrangements have subsequently been made to ensure appropriate supervision is available on call in the immediate future. Case allocation should be equitable and take into account individual development and support needs, while ensuring that all perfusionists within the department have appropriate opportunities to maintain and develop their skills. Consideration should also be given to identifying cases where two perfusionists should be present throughout the procedure. Irrespective of the mode of training or level of experience, significant personal or life events may affect an individual's readiness to return to complex clinical practice, and appropriate support and supervision should be available when required.

Type of incident:	Human Factors
Timing of incident:	CPB-hypothermic
Discussed with team:	Yes
Hospital incident filed	Yes
Ext Authority Advised	No
Supplies Issue	Yes
Knowledge issue	Yes
Protocol issue	No
Rule issue	No
Skill issue	Yes
Team Issue	Yes
Violation	No
Chance event	No
Patient outcome variance	Nil



Commentary The technical aspect of this report highlights the risks associated with using VAVD especially where not using proprietary VAVD controllers that have the appropriate safety pressure relief protection. While hard shell venous reservoirs have over pressure relief these may not alone provide protection where VAVD is used. Of note in "Vacuum-Assisted Venous Drainage: A 2014 Safety Survey." Journal of Extra-Corporeal Technology Murphy et al. of respondents 26.2% had encountered a pressurised venous reservoir resulting in retrograde air entrainment up the venous line, 33.3% had encountered a vacuum-regulator malfunction and 33.3% had encountered a wall-vacuum-source malfunction.

More importantly this report highlights the importance of effective teamwork and appropriate support when managing the complex systems involved in cardiac perfusion, especially in a case of this nature. The circumstances also highlight the potential for organisational and interpersonal factors to influence clinical risk. - *PIRS2 Editors.*

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