Post-operative Fluid Management In Adult Cardiac Surgical Patients: A UK National Survey

Dr Amit Chawla* Dr Ibrahim R Ibrahim^
* Cardiac anaesthetist ^ Specialty registrar
Guy's and St Thomas' NHS Foundation Trust

Introduction:

Crystalloid and colloid electrolyte solutions are used to maintain fluid and electrolytes balance and to replace ongoing loss in the peri-operative period. However, sodium, chloride and water overload is associated with postoperative morbidity, prolonged hospital stay, multi-organs failure and mortality (1).

Peri-operative fluid management in patients undergoing cardiac surgery can be quite challenging. The challenges are compounded by the underlying cardiac condition, complexity of the surgical intervention, cardiopulmonary bypass, hypothermia, and peri-operative renal dysfunction (2). Cardiac surgery related acute kidney injury (AKI) could prolong hospital stay (3). Therefore, progressive fluid and electrolyte overload can be a major contributor to patients' outcome.

Methods:

We conducted an online survey using Survey Monkey web-link. The survey consisted of 13 questions covering various aspects of post-operative fluid management. The survey was sent to all linkmen of ACTA (Association of Cardiothoracic Anaesthetists) at the 38 adult cardiac surgery centres.

Results:

We received responses from 20 out of 38 (52.6%) ACTA linkmen at the adult cardiac surgery centres in the UK. However, the response rate to the 13 questions was variable, see table 1 for details:

Questions	Answered	Skipped
1) How many cardiac surgical cases (on bypass) are performed per year in your cardiac centre?	20	0
2) Do you have a local protocol for fluid management in adult cardiac surgical patients?	20	0
3) Do you have a local protocol for: • Crystalloids • Colloids • Both • None	20	0
4) What type of fluid do you use for daily maintenance?	20	0
5) For daily maintenance fluid, what rate do you use?	17	3
6) When calculating daily maintenance fluid, do you use: • Actual body weight • Lean body weight • Don't base fluid calculation on weight	20	0
7) Do you take into account patients' underlying renal function (i.e. serum creatinine or eGFR) when calculating maintenance fluid requirements?	20	0
8) What type of fluid do you use for fluid challenge?	19	1
9) Do you have a limit on the colloid (excluding Blood products) administered in a 24-hour period?	10	10
10) When do you consider blood transfusion?	15	5
11) What is your trigger for diuretic administration?	9	11
12) What is your target positive fluid balance for crystalloids in the first 24-hour period post-operatively?	14	6
13) What is your target fluid balance for colloids in the first 24-hour period post-operatively?	14	6

Table 1: the response rate to the survey questions

The survey showed that 13/20 centres perform (500-1000) cardiac surgery, 5/20 (1000-1500), and 2/20 (>1500). Only 7/20 centres have local protocols for post-operative fluid management. Five of these protocols cover both crystalloid and colloid use, while the other 2 cover crystalloid use only.

For daily fluid maintenance, 10 centres use Hartmann's solution, 5 use 5% dextrose, and 5 use a combination of 0.18% saline and 4% dextrose. Two centres use plasma-lyte 148 as well. Fifteen out of 20 centres administer fluid at 1ml/kg/hr, 1/20 at 0.5ml/kg/hr, and 1/20 at > 1ml/kg/hr. The actual body weight is used to calculate fluid requirement in 17/20, the lean body weight in 1/20, while 2/20 did not base their calculation on body weight. Furthermore, only 13/20 considered patients renal function before calculating daily requirement.

For fluid challenge, 17/20 prefer gelatin solutions while 6/20 use Hartmann's solution. Three out of 20 use human albumin as well. Six centres administer a maximum of 1500ml of fluid challenge in 24hr, while 4/20 have decided not to exceed 20ml/kg/24hr.

The survey also showed that 11/20 consider blood transfusion when haemoglobin level drops below 80 g/l compared to 4/20 at haemoglobin below 85 g/l. Regarding diuretic use in the post operative period, all 9 respondents would consider patients cardiovascular status first, however, they would use diuretics for poor urine out (< 0.5ml/kg/hr for > 2 hours), hyperkalaemia and fluid overload at 77.7%, 77.7%, and 44.4%, respectively.

In the first 24 hours post-operatively, 7/20 aim for a positive crystalloids balance of 1000-2000ml, 6/20 for < 1000ml, and 1/20 for > 2000ml. For colloids, 9/20 aim for 500-1000ml, 2/20 for < 500ml and 3/20 for 1000-2000ml.

Discussion:

This survey confirms the fact that there is a variation in post-operative fluid management in adult cardiac surgical patients across the UK. It is showed there is no standard practice, as 13 centres out of 20 do not have local protocols for fluid management. Unfortunately, the current available studies do not allow us to make a final decision as to what solutions (crystalloids vs. colloids) to use and what fluid regimen to follow (2). However, this survey strengthens our conviction that post-operative fluid management in cardiac surgical patients is a dynamic process and prescription needs to be reviewed frequently taking into account patients' haemodynamic condition, post-operative renal function and ongoing losses. Frequent review of patients' colloid and crystalloid balances and appropriate use of diuretics should be encouraged.

References:

1- *British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patient GIFTASUP, The British Association for Parental and Enteral Nutrition (BAPEN0, the Association for Clinical Biochemistry, the Association of Surgeon of Great Britain and Ireland and Society of Academic and Research Surgery, the Renal Association and the Intensive Care Society. March 2011.*
2- *Fluid therapy in cardiac surgery patients. J. Schumacher, K.-F. Klotz. Applied Cardiopulmonary Pathophysiology 13: 138-142, 2009.*
3- *Fluid overload and changes in serum creatinine after cardiac surgery: predictors of mortality and longer intensive care stay. A prospective cohort study. Stein et al. Critical Care 2012, 16:R99.*