WEANING FROM CARDIOPULMONARY BYPASS

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ABSTRACT:
Prior to discontinuation of cardiopulmonary bypass condition that optimize cardiac and pulmonary function, these must be restored, which is achieved by reversing the process and technique used to initiate and maintain cardiopulmonary bypass. A key is to play close attention to all the details of preparation for emergence from bypass, including metabolic management ventilatory management, rewarming and potential problems of awareness. The decision to use an inotrope should be based on solid physiological evidence of poor inotropic state. Epinephrine is the drug of choice in general when an inotrope is needed, not dopamine or dobutamine. Nor epinerphrine may be substituted for epinephrine if considerable vasodilation has occurred. PJCTS 2000; II:14-16

INTRODUCTION

The development of extracorporeal circulation has been an extremely important event in advancement of the field of cardiovascular surgery. Today cardiopulmonary bypass is indispensable to the current practice of cardiovascular surgery. From the practical point of view cardiopulmonary bypass is not the sole preview of either surgeon, the perfusionist or the anesthesiologist. Instead each relies on expertise, cooperation and communication from others for the process to optimally proceed. The term weaning from cardiopulmonary bypass includes:

1. Preparation for separation
2. Separation from bypass

PREPARATION FOR SEPARATION:

Rewarming:

When systemic hypothermia is used, body temperature restored to normothermia by gradually increasing perfusate temperature via heat exchange. Several points need to be mentioned. Warming should not be too fast. Possible denaturation of plasmaprotein cerebral hypothermia and dissolved gas condensing in to bubbles are consequence of too rapid rewarming. Perfusate temperature should not be more than 100 degrees warmer than brain temperature. It is also possible to speed up rewarming by use of increased pump flow by use of vasodilators if necessary.

Target for rectal or bladder temperature prior to separation from cardiopulmonary bypass vary among institution but the key to rewarming is use of peripheral temperature usually bladder of rectal. This is important to prevent subsequent loss of heat to poorly perfused tissues as they open after emergence from bypass.

POTENTIAL AWARENESS DURING SEPARATION FROM BY PASS:-

During this patient often sweats profusely. This is not due to awareness, but rather the fact that hypothalamus is being perfused with heated blood. Awareness occur during cardiac surgery in one percent of patient. Following suggestions are made to attempt to limit possibility and sequence of awareness during cardiac surgery. First talking to the patient about the possibility of awareness in preoperative visit dose not hurt. If awareness is suspected supplement of amenistic and anaesthetic may be administered.

Volatile agents have consideration amenistic properties but during emergence the negative inotropism of volatile agents may not be desirable at this stage.

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ARTERIAL PRESSURE DURING REWARMING:-

During rewarming arterial pressure commonly drops secondary to vasodilation. There may be large discrepancy between the aortic root pressure and that in the radial artery during time. The cause of this is not known but it may be due to AV Shunting in forearm. It is advisable to gradually increase mean arterial pressure during rewarming to approximately 70-80 mmHg , so that the coronary perfusion pressure can be sufficiently high to completely reperfuse the myocardial tissues which has been paralysed with cardioplegia. The brain is also at risk at this age and relatively higher pressure may be protective to normothermic brain.

DEFIBRILLATION:-

Prior to discontinuation of cardiopulmonary bypass the heart must have an organized rhythm. It is important not to allow prolonged ventricular fibrillation because subendocardial perfusion is compromised and also because it is possible that if aortic valve is insufficient, left ventricle may distend during this time. It is now clear that large voltage shocks and large number of shocks do damage. Starting energies from 5-10 joules are now recommended.

RESTORATION OF VENTILATION:-

Prior to discontinuation of cardiopulmonary bypass the lungs must be reinflated. Positive pressure of 20-40-cmH2O is repeatedly applied until all areas of atelectasis are visually reinflated, specifically the left lower lobe, which seems more difficult to re expand. Fluid collected form the thoracic cavities during cardiopulmonary bypass is removed and a check for evidence of pneumothorax is also made.

CORRECTION OF METABOLIC ABNORMALITIES:-

When rewarming is nearly complete and separation from cardiopulmonary bypass is anticipated to occur in 10-20 minutes it is important to work hard to correct metabolic acidosis. There is no doubt that the ischemic and hypoxic myocardium is vulnerable to acidosis. Further acidosis dramatically reduces myocardial sympathetic responsiveness in the presence of acidosis.

With respect to electrolyte, potassium and calcium are usually of the greatest concern. Use of calcium is controversial, some have advocated raising the ionized calcium level to relatively normal level by administration of calcium chloride or calcium gluconate. It has been shown that calcium administration may contribute to myocardial reperfusion injury. Previously calcium was given routinely during separation from cardiopulmonary bypass but nowadays calcium is given when clearly needed hemodynamically and as measured by ionized calcium.

SEPARATION FROM BYPASS:-

During weaning and preparation for separation an assessment should be made of the functional states of the heart and peripheral vasculature based on visual inspection, hemodynamics indices and metabolic parameters. Based on these assessments, inotropes vasodilators and vasopressors thought likely to be required and should be prepared. After all preparatory steps are taken, cardiopulmonary bypass can be discontinued by gradual occlusion of the venous out flow line which forces the heart to eject blood it receives, while the patient intravascular volume and ventricle loading condition are restored by transfer of perfusate via aortic inflow line. When loading condition are optional the aortic inflow line is damped and the patient is now separated from cardiopulmonary bypass.

INOTROPIC SUPPORT:-

The decision to use inotropes depends upon patient hemodynamics parameters, but one should not forget that patients ventricle has been cross clamped for a considerable period of time and the heart has been seriously injured and its inotropic state is not good at this time.

During many separation from cardiopulmonary bypass the patient appears to bounce right of bypass with little difficulty, may be due to lightened state of anasthesia and adrenals are pumping out adrenaline at a great rate. The patient inotropic state is being stimulated endogenously, but at the same time patient potential awareness problem should be

dealt reasonably.
The decision to use inotrope is easy that is a poor rise in arterial pressure despite obviously high pre load as measured by left arterial or pulmonary diastolic pressure is indication or going back on bypass rethinking and starting an inotrope.

SELECTION OF INOTROPE:-

Epinephrine in most cases is the drug of choice, it is natures remedy. It is this hormone that the adrenal gland use when emergency situation arise. In cases where extreme vasodilation has occurred nor-Epinephrine is the drug which makes sense. Tapering Epinephrine over the next few hours in favour of dopamine or dobutamine can easily be done, but during the critical period of emergence from bypass there is little doubt that critical period of emergence from bypass there is little doubt that the drug of choice is Epinephrine. Epinephrine can be started in a dose of .05 ugm/ kg/ min which can be increased up to 1.0 ugm/ kg/min.If epinaphrine requirement is moving up to 2.0 ugm/kg/min than intraortic ballon support should be consider. It is a common experience that if the patient is given only dopamine or dobutamine during emergence from bypass, then the patient may well not have needed any exogenous inotrops at all.
Amrinone can sometime be a very useful adjuvant to Epinephrine. It should seldom be given in the absence of Epinephrine or nor Epinephrine because it might lead to much peripheral vasodilator and results in alarming drop in blood pressure.
Ionized calcium may need to be measured. Cautious doses of calcium may result in improvement. At this stage inotropic support may be more important than concerns about reperfusion injury.

NON PHARMACOLOGICAL SUPPORT:-

If despite high pre load, low output and low pressure then ballon support may be indicated. It is always advisable to think of ballon early, when it is obvious that difficulties are going to happen. Long periods of struggling on bypass and high inotropic support does not make lot of sense. Intraortic ballon is a useful adjunct in the small percentage of patients who gave sever inotropic state problems during emergence form cardiopulmonary bypass.

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