

Intraoperative hemodilution & autotransfusion

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A. Intraoperative Techniques of Blood Conservation

1. intraoperative phlebotomy before cardiopulmonary bypass
2. use of crystalloid oxygenator prime to achieve normovolemic hemodilution
3. intraoperative retransfusion of all blood removed by cardiotomy suction
4. reinfusion of all blood remaining in venous tubing and oxygenator after cardiopulmonary bypass.
5. acceptance of postoperative anemia in patients in hemodynamically stable condition
6. adequate hemostasis

(1) Withdrawal of autologous blood before C-P bypass

1. total blood volume의 15-20%를 제거하고 crystalloid solution으로 isovolemic replacement
2. contraindication
 - a. substantial anemia preoperatively
 - b. severe aortic stenosis
 - c. left main disease, or unstable angina
3. autologous blood는 짚외순환을 끝내고 heparin을 증파하고 수술 출혈점을 조절한 다음에 주입
4. homologous blood requirement를 20-58% 로 감소
5. plasmapheresis에 의한 PRP(platelet-rich plasma)를 수술직전에 분리하였다가 수술후 주입으로 perioperative로 소실되는 적혈구용적과 동종혈액수혈의 양을 의의있게 줄일수 있다.

(2) Use of crystalloid oxygenator prime

1. normovolemic hemodilution(Hct 0.20-0.30)
2. decreased viscosity with acceptable oxygen carrying capacity로서 CPB를 요하는 수술에서 수혈 요구량을 30-50% 감소 시킬수 있다.

3. 잇점

- a. blood conservation
- b. improved postoperative pulmonary & renal function as a result of decreased slugging and aggregation of formed blood elements
- c. intraoperative & postoperative metabolic acidosis ----->less severe

4. 단점

- a. increase in extracellular fluid (mostly in interstitial compartment)

(3) Intraoperative blood salvage

: operation에서 흘러 나오는 혈액을 pump-oxygenator에 보내서 재주입 하는 것으로 재주입전에 deformer & filtered reservoir를 통과 시킨다.

- 1. high-power discard or wall suction with blood processing system
- 2. routine drainage of all venous blood into oxygenator with reinfusion of oxygenator contents after decannulation

3. methods

- a. pumping the remaining blood in the venous reservoir through the hemofilter with a roller pump =less time consuming
- b. centrifugation

B. Postoperative Techniques of Blood Conservation

(1) Postoperative autotransfusion of shed mediastinal blood

- Elmendorf: traumatic hemothorax로 부터 흘러 나오는 혈액을 autotransfusion하는 것을 처음 기술
- Schaff : elective cardiac procedure후 증격동으로 부터 재집한 혈액의 자가혈을 처음 보고
- 1. coagulation protein의 소실과 동반하는 clot formation의 활동적인 과정이 mediastinal & pleural space에서 일어나서 shed blood는 보통 clot formation을 않는다.

(2) Postoperative autotransfusion system

1. Sorenson system

2. Systems incorporating commercially available cardiotomy reservoir

3. 잇점

a. risk of contamination is decreased by maintenance of closed system

b. integral 20-um filter provides improved filtration of mediastinal drainage

c. greater hemodynamic stability is achieved by continuous reinfusion of shed blood

d. cost-effective & readily accepted by nursing personell

e. applicable for use in patients who are Jehovahs Witness

(3) Clinical experience with autotransfusion

1. Schaff: homologous blood requirement를 50%로 낮출수 있었다.

2. Thurer: 슬후로 total blood transfusion 양(homologous & autologous) autotransfusion group에서 더 크다

3. Adan : homologous blood의 사용이 50% 감소 했으나 완전히 donor blood의 사용을 피할 수 없었다.

(4) Safety of postoperative autotransfusion

1. Hematologic(coagulation abnormaliteis)

: mediastinal drainage를 받았던군과 받지 않았던군을 비교시 수술후 어느 시기에 도 차이점은 없었고 systemic fibrinolysis와 같은 sentive marker 또한 postoperative autotransfusion을 받았던 환자에서 상승되지 않았다.

2. Infection & renal problems

: no difference