CASE REPORT

Strategies to lower the central venous pressure during liver resections

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ABSTRACT

All means to reduce blood loss in liver resection and to decrease blood loss and a need of blood transfusion would be of benefit to the patient as well as the surgeon. We report two cases in which different strategies were applied in order to achieve the low central venous pressure. We also compared in these cases surgical time, blood loss and blood transfusion requirements during liver resection.

Key words: Liver resection; Central venous pressure; Blood loss

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INTRODUCTION

Major hepatic resections with low central venous pressure (CVP) allows easy control of the hepatic veins before and during parenchymal transection. The anesthetic technique, designed to maintain CVP at a low level during the critical stages of hepatic resection, not only help to minimize blood loss and mortality but also the surgical time. The volume of blood loss and blood transfusion during liver resection correlate with the CVP during parenchymal transection. Lowering the CVP to less than 5 mmHg is a simple and effective technique to reduce blood loss during liver resection and reduce the need for blood products.

CASE REPORT 1

A 55 years old female, 69 kg weight, hypertensive controlled on atenolol 5 mg daily was scheduled for right lobe liver resection. Preoperatively hemoglobin was 11 g/dl and liver enzymes were mildly elevated but there was no evidence of distant metastasis. Before induction of general anesthesia low thoracic epidural catheter was placed. After epidural insertion general anesthesia was induced with inj. fentanyl 2 μg/kg, propofol 2 mg/kg and cisatracurium 0.2 mg/kg. The patient's lungs were ventilated with 100% oxygen and 2% sevoflurane for three minutes and trachea was intubated with 7 mm cuffed PVC endotracheal tube. General anesthesia was maintained with sevoflaurane 1.5-3% in 40% oxygen. The nasogastric tube and Foleys urinary catheter were inserted. The arterial line was inserted in left radial artery and triple lumen central venous line was inserted in the right internal jugular vein. Intra-operatively infusions of remifentanil (0.05 μg/kg/min), cistracurium (2 mg/hour) were started. Bolus of bupivacaine 0.25% 8 ml given followed by epidural infusion of bupivacaine 0.25% (6 ml/hour) continued. Patient was monitored with ECG, SpO_2, invasive arterial blood pressure, CVP, entropy, temperature and urine output. Baseline vitals were heart rate 64/min, BP 115/68 mmHg, SpO_2 100% and CVP was 16 mmHg. In the pre-hepatic period (before liver resection) the following measures were taken to lower down the CVP gradually up to 5 mmHg. Patient turned 15° reverse Trendelenburg position, CVP dropped to 12 mmHg. After fifteen minutes infusion of glyceryl trinitrate (titrated from 5-15 μg/min) was started, and IV fluids were restricted to 1 ml/kg. Intraoperatively CVP dropped up to 10 mmHg. Blood loss was 1000 ml in six hours surgical procedure. Hemoglobin dropped

to 8.5 g/dl so blood loss was replaced with two units of packed red blood cells. At the end of the procedure patient's trachea was extubated and he was shifted to HDU.

CASE REPORT 2

A 63 years old male, 87 kg weight and hypertensive controlled on tab. lisinopril 10 mg and tab. atenolol 50 mg daily, was scheduled for right lobe liver resection. Preoperatively liver enzymes were within normal limits. Baseline hemoglobin was 9.0 g/dl and there were small lung metastasis. Before induction of general anesthesia low thoracic epidural with catheter was placed. After epidural insertion general anesthesia was induced with inj. fentanyl 2 μg/kg, propofol 2 mg/kg and cisatracurium 0.1 mg/kg. The patient's lungs were ventilated with 2% sevoflurane in 100% oxygen and trachea was intubated with 8 mm cuffed PVC endotracheal tube. General anesthesia was maintained with sevoflaurane 1.5-3.0% in 40% oxygen. The nasogastric tube and Foleys urinary catheter were inserted. The arterial line was inserted in left radial artery and triple lumen central venous line was inserted in right internal jugular vein. Intraoperatively infusions of remifentanil (from 0.05 μg/kg/min), cistracurium (2 mg/hour) were started. Epidural bupivacaine 0.25% 10 ml bolus was given followed by an infusion of bupivacaine 0.25% at a rate of 6 ml/hour. Patient was monitored with ECG, SpO_2, invasive arterial blood pressure, CVP, entropy, temperature and urine output. Baseline vitals were heart rate 57/min, BP 125/78 mmHg, SpO_2 100% and CVP was 22 mmHg. In the pre-hepatic period (before liver resection) the following measures were taken to lower down the CVP gradually up to 5 mmHg. Patient was turned 15^0 reverse Trendelenburg position, after which CVP dropped to 16 mmHg. Fifteen minutes later infusion of glyceryl trinitrate (titrated from 5-15 μg/min) started, and fluids were restricted to 1 ml/kg. Introperatively CVP dropped up to 13 mmHg. Then after thirty minutes of this drop in CVP, mannitol infusion was started at 0.5 g/kg, CVP dropped to 8-9 mmHg after 30 min. Then after 5 min furosemide 10 mg was given, CVP dropped to 4-5 mmHg after 20 minutes. Blood pressure dropped to 80/50(55) mmHg and was maintained by norepinephrine 0.2 μg/kg/min. Blood loss was 400-600 ml in four hours surgical procedure. Hemoglobin dropped down to 7 g/d and replaced with two units of packed red blood cells. At the end of the procedure the patient was hemodynamically stable and his hemoglobin was 9.5 g/dl. His trachea was extubated and he was shifted to HDU.

DISCUSSION

Different measures are usually employed by the anesthesiologists to reduce bleeding by reducing hepatic venous engorgement. All these measures depend upon the use of patient monitoring employed, the extent of the liver mass to be resected, whether liver is cirrhotic or non cirrhotic, and absence or presence of coagulation defects. Average time and blood loss for liver resection is 4 to 6 hours and 1 to 2 liters respectively. In both cases our main aim was to keep CVP low (around 5 mmHg) to reduce the surgical time by facilitating the surgeon, and minimizing the risk of intraoperative surgical bleeding and subsequent bleeding. Commonly used methods to reduce CVP are IV fluid restriction, venodilatation, decrease venous return and volume contraction. Maintaining the CVP ≤5 mmHg is a simple and effective method to reduce blood loss during liver resection and reduce the need for blood transfusion and its hazards.[1]

In our first case we used 15^0 head up position, glyceryl trinitrate (for venodilatation) and IV fluid restriction to lower down the CVP. In second case, in addition to above measures, we used IV mannitol bolus and IV furosemide (for volume contraction). Also in this case we used small doses of norepinephrine boluses to keep mean arterial pressure in the range of 55-60 mmHg. As low CVP associated with low mean arterial pressure i.e. can compromise perfusion and oxygenation of vital organs e.g. brain, heart and kidney etc.

Maintaining low CVP during hepatic resection decreases the distension of hepatic veins and thus markedly decreases bleeding.[2] Low CVP has also been shown to reduce morbidity and reduction of hospital stay time.[3,4] In our second case, maintaining the CVP up to 5 mmHg resulted in significant reduction in blood loss as compared to the first case in which CVP was up to 10 mmHg. In both cases maintenance fluids were restricted to 1 ml/kg/hour to stabilize systolic blood pressure up to 90 mmHg and ensure diuresis of at least 0.5 ml/kg/hour.[5] Fluid restriction alone was insufficient to keep CVP at a desired level in both cases, so we used vasoactive agents as glyceryl trinitrate. It resulted in reduction of CVP up to 10 mmHg. During the resection phase, or when oozing observed from the resected surface, glyceryl trinitrate was helpful to some extent to maintain low CVP.[6,7]

The use of reduced doses of mannitol (an osmotic diuretic) along with furosemide (a loop diuretic) for volume contraction can be helpful in lowering CVP. As we used both agents in our second case

along with other measures, it resulted in significant reduction of CVP and in blood loss as compared to measures used in our first case. The role of mannitol infusion and synergistic effect of furosemide has already been well documented, especially in lowering of intracranial pressure by reducing central venous pressure and subsequently cerebral blood volume.

CONCLUSION

A low central venous pressure equal to or less than 5 mmHg during hepatic resections is a useful means to decrease intraoperative bleeding, thus minimizing the need of blood transfusion and to reduce the surgical time.

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