Cardiothoracic Anesthesia, Respiration and Airway

Transesophageal echocardiography diagnosis of tricuspid obstruction by a vena cava tumour

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Purpose: To present the anesthetic management for excision of a primary tumour of the inferior vena cava.

Clinical features: Resection of a primary tumour of the inferior vena cava without extension to the right atrium was scheduled without extra-corporeal circulation (ECC). The operation consisted of tumour excision with transtumoral clamping. During the immediate postoperative period, tricuspid obstruction was suspected when a "cannon a wave" was recorded from the right atrial pressure curve. Transesophageal echocardiography confirmed the diagnosis of tumour obstruction of the tricuspid valve.

Conclusion: Tricuspid obstruction due to postoperative mobilization of a primary tumour of the inferior vena cava was diagnosed by transesophageal echocardiography. Perioperative management particularities of the primary tumour of the vena cava are discussed.

Objectif : Présentation de la prise en charge périopératoire d'une intervention de résection d'une tumeur primitive de la veine cave inférieure, stratégie non trouvée dans la littérature.

Observation clinique : La résection d'une tumeur de la veine cave inférieure, non étendue à l'oreillette droite, a été planifiée sans circulation extra-corporelle. L'intervention a consisté en la tumorectomie avec ligature transtumorale de la veine cave. Au cours de la période postopératoire immédiate, une obstruction tricuspидienne a été suspectée devant l'apparition d'une onde a géante sur la tracé de pres-

sion veineuse centrale. Le diagnostic d'obstruction tricuspидienne tumorale a été confirmé par une échocardiographie transoesophagienne.

Conclusion : L'obstruction tricuspидienne secondaire à la mobilisation postopératoire d'une tumeur primitive de la veine cave inférieure a été diagnostiquée par échocardiographie transoesophagienne. Les particularités de cette chirurgie et de l'anesthésie sont exposées.

P RIMARY tumours of the inferior vena cava are extremely rare, and there are no reports of the anesthetic management involved in their excision.¹⁻³ We report a case of mobilization of an inferior vena cava tumour that was responsible for postoperative acute tricuspid obstruction. Transesophageal echocardiographic data and hemodynamic developments are considered as surgical difficulties of removing the tumour.

Case report

A 48-yr-old woman was seen for recent right abdominal pain associated with right leg pain and edema. Clinical examination revealed a right paraumbilical abdominal mass. Computed tomography confirmed the presence of a right retroperitoneal tumour involv-

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Accepted for publication 3 December 2000.

ing the retrohepatic segment of the inferior vena cava suggestive of a primary tumour of this vessel. Venacavography showed that the tumour mass had developed to the detriment of the vena cava wall obstructing nearly all of the lumen, and spread to the end of the inferior vena cava. A large collateral network was visualized at the level of the lumbar veins and the azygos vein. Because of the absence of tumour spread to the right atrium, and normal transthoracic echocardiography, it was decided to perform surgical excision without cardiopulmonary bypass. The preoperative clinical examination had no particularities and 12-lead ECG was normal.

After premedication with 2 mg lorazepam, anesthesia was performed with total doses of 50 mg midazolam, 175 µg sufentanil and 80 mg atracurium. The usual intraoperative monitoring was completed by monitoring of pressures with pulmonary and radial arterial catheters. The operation lasted five hours and required clamping of the inferior vena cava and the aorta for about 15 min. Intraoperative vascular fluid included 4.5 L crystalloids, 1.5 L modified fluid gelatin, 1.5 L hydroxyethylstarch and five units red blood cells. The operation consisted of tumour excision with ligation of the right renal vein. The upper pole of the tumour was tied with transtumoral clamping of the inferior vena cava. Pericardiotomy revealed a small intrapericardial effusion. As the procedure could not be completed without risk using the established operating conditions, surgery was stopped to consider possible complementary excision with cardiopulmonary bypass and the patient was transferred to the ICU.

In the ICU, arterial pressure was 120/90 mmHg and heart rate 120 bpm. Auscultation mimicked a right gallop rhythm. Mean arterial pulmonary pressure (MPAP) was 15 mmHg, pulmonary artery occlusion pressure (PAOP) 4 mmHg, and the right atrial pressure (RAP) curve showed an atypical feature, "canon a wave" (Figure 1), with pressures of 20/6-11 mmHg. Variations in the systemic arterial pressure curve were also noted, with a respiratory cycle suggestive of hypovolemia. One litre of modified fluid gelatin was then perfused. However, arterial hypotension occurred at 75 mmHg systolic arterial pressure (SAP), MPAP was 10 mmHg, PAOP 8 mmHg, and RAP 10 mmHg. Dopamine was infused at 5 and then 8 µg·kg⁻¹·min⁻¹. The canon a waves were always present. Transthoracic echocardiography showed right atrial stasis with no visible obstacle to vascular filling, tricuspid insufficiency or intrapericardial effusion. The right ventricle appeared to be empty. The remaining tumour was visible at the point where the inferior vena

FIGURE 1 Multichannel recording of ECG (HR), arterial pressure (AP) and right atrial pressure (RAP). Tricuspid obstruction due to tumour migration from the inferior vena cava was responsible of right atrial emptying impairment causing a marked increased in RAP with a striking end-diastolic a wave (« canon » a wave).

cava reached right atrium. Despite complementary filling (0.5L hydroxyethylstarch and 0.5 L gelofusine), the hemodynamic state rapidly worsened (SAP = 55 mmHg). Transesophageal echocardiography showed an echogenic mass at the level of the right atrium which blocked the tricuspid valve and prevented any filling of the right ventricle (Figure 2). Reoperation with cardiopulmonary bypass was decided but the family preferred not to resume the operation. The patient died shortly afterwards.

Discussion

This experience emphasizes the difficulties in surgical and anesthetic management of a tumour in the retrohepatic segment of the inferior vena cava. Immediately after surgery, prominent « canon a » waves were recorded on the RAP tracing (Figure 1).⁴ This feature corresponds to extreme intra-atrial pressure during atrial systole induced by an obstruction. It can be caused by rhythm disturbances due to atrioventricular dissociation or a junctional rhythm producing atrial systole when the tricuspid valve is closed. In our case, this possibility was excluded since sinus rhythm was present and the ECG tracing was normal. Acute tamponade is another possibility, given the high RAP and the likelihood of bleeding secondary to intraoperative heparinization and opening of the pericardium. However, transthoracic and transesophageal echocardiographic examinations

FIGURE 2 Transesophageal echocardiography imaging of the right atrium and ventricle (RV) with the tumour (T) obstructing the tricuspid valve.

showed no pericardial effusion.

The most likely cause was that mobilization of the migrant tumour at the level of the right atrium prevented filling of the right ventricle. Initially, upon return from the operating room, the patient's hemodynamic state was altered by the relative hypovolemia related to a reduction in venous return. Hypovolemia was revealed by tachycardia and arterial pressure variations with mechanical ventilation. A right atrial curve with a tall « a » wave was already present and persisted throughout the postoperative period. It is surprising that a mass of the size revealed in the transesophageal echocardiography was not seen with transthoracic echocardiography as both examinations were performed by the same cardiologist and anesthesiologist experienced in echocardiography. Two possibilities were hypothesized: First, transthoracic echocardiography is more limited than transesophageal echocardiography. False negative results with transthoracic echocardiography are commonly reported in contrast to transesophageal examination

which always visualizes the auricular or paracardiac tumours.⁵⁻⁸ Second, the tumour was always close to the wall of the vena cava, was mobilized intermittently, and was not visualized at the time of transthoracic echocardiography. Transesophageal echocardiography clearly showed the tricuspid obstruction due to the tumour mass. Recent reports of tricuspid inflow obstruction and pulmonary embolism underline the usefulness of transesophageal echocardiography in the diagnosis during the per and postoperative periods.^{9,10}

Histopathological examination of the surgical specimen confirmed the preoperative diagnosis of a leiomyosarcoma of the inferior vena cava.¹⁻³ This primary malignant tumour develops from smooth muscle cells of the inferior vena cava. Fewer than 200 such tumours have been reported.³ The difficulty for surgical management depends on the topography of the tumour.¹⁻³ Excision of a tumour located below the orifice of the renal veins is generally easy, whereas removal of a suprarenal tumour is often difficult, especially when it has spread to the liver. Tumours involving the cavo-renal confluence and the suprahepatic inferior vena cava can be operated upon by the abdominal route when they are not too large, which requires complete clamping of the suprarenal inferior vena cava. Exclusion of the liver by triple clamping is generally necessary and justifies hemodynamic monitoring through pulmonary catheterization. Only when the tumour extends into the right atrium, is cardiopulmonary bypass necessary.

In the absence of hepatic and renal involvement, an abdominal approach was chosen in our case. Furthermore, we wanted to certify that tumour resection was possible because cases have been reported in which it has proved technically impossible when tumours spread beyond the suprahepatic veins.¹¹ Unfortunately, the degree of tumour spread led to incomplete surgery and ligation of the inferior vena cava, with venous return ensured by the collateral circulation, as clearly visualized in the preoperative study.

Preoperative transesophageal echocardiography has never been recommended in the preoperative evaluation for resection of a leiomyosarcoma of the inferior vena cava. In view of this case with unexpected higher spread of the tumour not identified despite venocavography and transthoracic echocardiography, transesophageal echocardiography may be considered when the tumour extends to the origin of right atrium. Both pre and peroperative transesophageal echocardiography examinations may assist surgical decisions and patient's anesthetic and critical care management. Similar patients might be operated upon in a cardiac surgery operating room, under continuous transesophageal echocardiography examination, with stand-by car-

diopulmonary bypass. However, this management does not preclude successful operation as far as tumour extension may render restitution of prosthetic vena cava wall difficult.¹ Finally, the very poor oncologic prognosis of this neoplasm, in contrast to the relatively good one of renal carcinoma, must be taken in consideration when surgical indication is debated.

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