HYBRID OPERATION OF POSTTRAUMATIC DISSECTING ANEURYSM OF DESCENDING AORTA – CASE REPORT

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A case is presented of a 48-year old patient, hospitalized in 1st Clinic of General and Vascular Surgery, 2nd Medical Faculty, Warsaw Medical University. The patient underwent successful hybrid treatment for a dissecting aneurysm of the descending aorta. The dissection was repaired using a bimodular stent-graft Zenith TX-2 Zenith, Cook, covering origins of the left subclavian artery and left common carotid artery. Blood flow in the neck was restored using non-anatomical anastomoses: the left common carotid artery was connected with the right common carotid artery and left subclavian artery.

Key words: aortic dissection, hybrid operations, non-anatomical graft

Aortic injuries are directly life threatening. Majority of patients dies at the site of event or dies soon after being transported to the hospital. Delayed diagnosis and abandoning of immediate treatment decrease the chance of patient survival. Massive chest injuries can result in injury of the main aortic trunk and “large vessels” originating from its arch. The most common mechanism of thoracic aorta injury is “sudden deceleration” due to traffic accident of fall from a great height (1). Both patient prognosis as well as possibility of treatment largely depend on location and extent of injury of the vessel wall. Transmural aortic rupture results in immediate hemorrhage and death before help arrives. Hospital treatment is available only for patients in whom partial rupture of aortic wall occurred. The defect most commonly involves adventitia or intima (2). In some cases, injury may result in rupture of the media and formation of an intramural false canal i.e. dissection. Aortic dissection carries a risk of aortic wall rupture and massive extravasation of blood into the chest or ischemia of abdominal organs, intestines and lower limbs. The injury may also result in aneurysm formation (3).

Aortic injuries can be repaired using conventional methods, through thoracotomy, some can be repaired using endovascular methods and some cases require combination of both these methods i.e. hybrid operation.

Here we present a case of the patient who underwent the hybrid operation due to post-traumatic dissecting aneurysm of descending aorta.

CASE REPORT

A patient J.C. (medical record no. 1241/07), age 48 years, visited an emergency department due to chest pain radiating to his back. He had a history of two myocardial infarctions, one and three years ago, treated medically, uncontrolled hypertension and chest trauma that he sustained seven months earlier during a traffic accident. Physical examination revealed pathological obesity (BMI 43.1 kg/m²). The patient was in good general condition, his
cardiovascular and respiratory systems were stable. Auscultation demonstrated symmetrical vesicular sounds over the lung fields, without additional sounds, regular heart rate 80 bpm. The pulse was normally felt on peripheral arteries. No peritoneal signs were detected and intestinal peristalsis was normal. Laboratory tests and ECG ruled out another myocardial infarction. Apart from slight anemia (hemoglobin 12 g/dl, red blood cell count 3.5 M/mm$^3$), there were no other abnormalities. Chest X-ray demonstrated widened mediastinal shadow. Imaging diagnostic work-up was expanded and computed tomography imaging with intravenous administration of a contrast agent was performed. This demonstrated a dissecting aneurysm of descending aorta that had diameter of 51 mm in its widest portion, in the area of aortic isthmus. The dissection began at the level of origin of the left subclavian artery and reached the celiac trunk that was supplied from both true and false canals. Starting from entry of the dissection, diameter of the true canal was from 6 to 12 mm, while that of the false canal was from 37 to 44 mm; length of the dissection was estimated to be 165 mm (fig. 1). The patient was qualified for an urgent operation.

Preoperative echocardiography demonstrated a significant post-myocardial infarction damage of the myocardium, with ejection fraction of 35%. Various treatment options were considered and a decision was made to use an endovascular method. Safe aneurysm repair required covering of origin of the left subclavian artery with a stent-graft; there was also a high risk of obstruction of the common carotid artery that originated immediately before it. This required non-anatomical by-passes. Feasibility of this operation and possible complications were fully explained to the patient who signed consent for the suggested treatment.

It was a two-stage operation. First stage involved, after regional anesthesia, two sections along sternocleidomastoid muscles. A polytetrafluoroethylene graft with 8 mm diameter, connecting right and left common carotid arteries, was passed subcutaneously with anastomoses “end-to-side”. Thereafter the left common carotid artery and left subclavian artery were cut, their remnants were ligated and distal portions were connected together, using an “end-to-end” anastomosis (fig. 2). Very good pulsation was obtained both in the graft and anastomosed arteries. The surgical procedure took 150 minutes. Intraoperative blood loss was approximately 150 ml. Before arterial clamps were used, 3500 IU of unfractionated heparin was given intravenously. No significant drop of blood pressure or neurological disorders were observed during the operation.

Fig. 1. Computed tomography angiography, MIP projection, performed before an operation. Blue arrow indicates beginning of the dissection, yellow arrow – origin of the left common carotid artery. Red asterisk – true canal, white asterisk – false canal

Fig. 2. Intraoperative photograph. A carotid-carotid polytetrafluoroethylene graft can be seen. Blue asterisk indicates a remnant of the left common carotid artery. Yellow asterisk – vascular anastomosis of the left subclavian artery with the left common carotid artery
In the second stage, under epidural anesthesia (a catheter was inserted before the operation of carotid arteries), through the left femoral artery, after administration of 5000 IU of unfractionated heparin, a bimodular stent-graft Zenith TX-2 was implanted, covering the bifurcation and origin of the left common carotid artery and left subclavian artery. During the stent dilatation, a transient asystoly was induced by administration of 60 mg of adenosine and the whole procedure was performed with systolic blood pressure reduced to 100 mm Hg. Postoperative arteriography demonstrated normal flow through both stent-graft and non-anatomical by-passes. Complete coverage of the dissection and exclusion of the false canal were achieved. No leak was demonstrated. The procedure took 90 minutes. Intraoperative blood loss was 100 ml.

During the hospitalization, the patient was given subcutaneous enoxaparine 60 mg daily and oral ticlopidine 2 x 250 mg daily and intravenous ceftriaxone 2 x 1.0 g. The postoperative period was uncomplicated. On day 5 the patient, in good general and local condition, with normally palpated pulse over lower and upper limb arteries, without neurological deficits, was discharged home (fig. 3). Computed tomography imaging, performed 6 months after the operation, demonstrated normal flow through arteries and vascular by-passes. No leak or stent-graft migration was demonstrated.

**DISCUSSION**

Type B aortic dissection can be treated medically or surgically or using stent-graft and endovascular technique.

Patients with descending aorta dissection, not accompanied by life-threatening complications, are treated medically in a hospital. Patient is followed-up for several weeks in an attempt to reduce arterial blood pressure, preventing progression of the dissection. Aortic wall is believed to undergo fibrosis during this time, which prevents its rupture (4). However mortality rate of patients treated medically is 50% in 5-year follow-up. Despite satisfactory early results, false canal enlargement or aneurysm are found in 25% over 4 years of follow-up (5).

Surgical treatment of thoracic aorta injuries is a challenge even for most experienced vascular surgeons and may be undertaken only at specialist centers, equipped with adequate equipment and trained personnel. Perioperative mortality and complication rate, including irreversible damage of spinal cord, are very high and ranges from 14% to 57% in various authors (6). Conventional operations require thoracic aorta clamping to repair a defect in its wall or to implant a graft at an injured place. Risk of spinal cord injury may be reduced by use of partial or complete extracorporeal circulation or cerebrospinal fluid drainage (7). Another method involves use of temporary shunt from ascending aorta to descending aorta, below the clamp (8).

Progress in endovascular techniques allowed to use stent-grafts in the treatment of pathologies of descending aorta, reducing perioperative mortality and complications (9). Endovascular treatment does not require aortic clamping and therefore significantly reduces the risk of disturbances in blood supply to the spinal cord that are estimated to occur in 3-7% of cases (10). It may be done under local anesthesia, therefore in hemodynamically unstable patients. Early results of endovascular treatment are promising. According to various authors, technical success occurs in
79-100% of cases while mortality ranges from 0 to 27%, however others emphasize that long-term results of this method are still unknown and the above mentioned studies enrolled small numbers of patients (11). Dake was the first to implant stent-grafts to exclude descending aorta aneurysms in 1991 (12).

Most commonly posttraumatic aortic dissection begins approximately 2 cm below the origin of the left subclavian artery (13). Success of the procedure mainly depends on correct position of proximal part of the graft. At least one segment of the stent-graft (1.5-3 cm) should adhere to the healthy aortic wall to prevent a leak. When the dissection involves or begins at the level of the left subclavian artery, the artery must be covered which may lead to steal syndrome and in rare cases to ischemia of the upper limb. In this group, to ensure blood supply to the limb, subclavian-carotid by-pass or subclavian artery transposition to the common carotid artery must be done (14).

In our patient, due to proximity of origin of left common carotid artery and left subclavian artery, implantation of a stent-graft carried high risk of simultaneous obstruction of these both vessel. To avoid neurological symptoms, a decision was taken to perform a non-anatomical carotid-carotid by-pass. Due to a possible recurrent leak, they were ligated and the remaining fragments of the arteries were anastomosed “end-to-end”. This prevented possible complications related to ischemia of the upper limb and steal syndrome. Some authors believe that a transposition or subclavian-carotid by-pass are necessary only when symptoms of steal syndrome occur (15). Other authors attempt to restore blood flow using non-anatomical by-passes on large arteries originating from the aortic arch (16). In our case this would require repeated vascular operation in scarred tissues and temporary blockade of blood flow in the left common carotid artery. This could result in neurological complications or thrombosis of carotid-carotid by-pass.

Positioning of a stent-graft is hampered by aorta motions related to heart beating and respiration. Blood flow additionally hampers precise dilatation of an endovascular graft, pushing it to the periphery. Therefore it is advisable to reduce blood pressure or temporarily arrest the heart using adenosine or rapid ventricular pacing using an external pacemaker during dilatation of a proximal stent-graft (17).

Recently there have been reports documenting attempts to use fenestrated and bifurcated stent-grafts and “chimney” and “double-barrel” techniques that allow preservation of blood flow in the large arteries originating from aortic arch, in the treatment of dissections and aneurysms involving the aortic arch (18). Procedures of this type are performed only in a few centers around the world. The design and making of such graft takes a few weeks which limits utility of this method to stable patients (18, 19).

Hybrid operations of the thoracic aorta and its branches are a chance for patients who require urgent surgical treatment. Combination of surgical and endovascular treatment allows to avoid thoracotomy, temporary blockade of blood flow in the aorta or extracorporeal circulation. This is of particular importance for patients with multiple medical disorders. Such operations may be performed only at selected centers, using specialist equipment, basing on modern imaging modalities, by an experienced medical team consisting of vascular surgeons, radiologists and anesthesiologists.

REFERENCES


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