CHAPTER VII - Acute Aortic Dissection

7.1. **Background.** Acute aortic dissection is a major medical and surgical emergency, where blood penetrates between aortic parietal structures, by intimal tear, threatening the patient's life. Along with acute myocardial infarction, it contributes to increased rate of cardiovascular mortality. Although identified as a pathological entity since the XVIth century, surgery could be successfully addressed only in the last 50 years, with the introduction of extracorporeal circulation in cardiovascular practice arsenal. Modern approach of this pathology was made by DeBakey in 1955, who resected the dissected segment of descending aorta and performed an end-to-end anastomosis. This was followed by rapid progress in addressing the aortic valve that is involved in the dissection process, either by repair or by replacement with a composite graft, the Bentall-DeBono operation in 1967. Aortic arch lesion approach was made possible by perfecting the technique of total circular arrest in deep hypothermia, with modern methods of brain protection. All this led to the routine approach in cases of aortic dissection in most cardiac surgery centers to lower operative mortality to 5-10%.

**Incidence.** Estimated at 1 / 10 000 hospitalized cases, but much more common on large necroptic studies, in which 1 / 600 cases are considered to have acute aortic dissection as the factor that caused or contributed to death.

**Etiology.** Diseases leading to weakened resistance of the aortic walls may be genetic or acquired.
- Genetic disorders: Marfan syndrome, Ehler-Danlos syndrome and annuloaortic ectasia.
- Acquired diseases: degeneration, atherosclerosis, inflammatory, traumatic, iatrogenic, toxic.

a). Genetic diseases.
- Marfan syndrome - is a disorder of connective tissue, which is transmitted autosomal dominant and affects the system, bone, eye, cardiovascular, lung, skin. This complex combination of disorders was first described in 1896 by Antoine Marfan, a girl of six years that this exaggerated growth in length of bones. Other 50 years passed before he made the correlation between the disorder of connective tissue and cardiovascular system damage, especially mitral valve damage and development of aneurysm and dissection. Diagnosis is made mainly on clinical criteria and supported by genetic studies that identified mutations in the gene producing Fibrillin-1 microfibrilelor constituent of the aortic wall. Diagnosis of cardiovascular events in patients with clinical criteria of Marfan syndrome, is essentially to prevent complications sometimes disastrous, as aortic dissection and rupture of an aortic aneurysm. The prognosis of these patients is dictated largely by cardiovascular damage, and usually die by these complications decade II or III life. Quantifying damage heart and great vessels is made by radiographic studies, echocardiography, CT, MRI, arteriography. Treatment is mainly medical and surgical when they meet the criteria of operability of an aortic
aneurysm, impaired mitral, aortic dissection or acute emergency.
- Ehler Danlos Syndrome - is a heterogeneous group of irregular connective tissue, characterized by hipermobile joints, hiperextensibilitate skin and tissue fragility. At the genetic level is broken chain of collagen pro alpha-1 type III. Aorta damage is expressed by decreasing resistance parietal, dilated aneurysm and dissection.
- Ectazia anuloaortica a notion introduced by Ellis in 1961, found in 5-10% of patients operated for aortic regurgitation. Found a correlation between this loss of elasticity of the aorta, the walls mucopolizaharide deposits and development of aneurysms and aortic dissection.

b) – Acquired diseases.
- Atherosclerosis, is the leading cause of development of aneurysms, with the aging process. Degenerative changes may lead to rupture and the development of intimal dissection. Dissection process may occur in 65% of cases with degenerative atherosclerotic aneurysms located on ascending aorta.
- Injuries. Especially in traffic accidents, 15-20% of causes of death are given the trauma of the aorta. Immediate aortic rupture, only disruptive intima, aneurysm development, the association with heart damage, myocardial contusion is an emergency of this chapter etiological itself. In order of severity of traumatic injuries can meet aortic parietal, parietal hematoma, parietal hemorrhage with laceratie female laceratia average, total parietal laceratie, periadventicial pseudoanevrismul and hematoma.
- Iatrogenic aortic dissection can occur, and after cardiac surgical procedures, interventional (angioplasty), heart massage.
Aortic dissection can occur immediately after cardiac surgery (instead of Tubular aortic, femoral, proximal anstomozelor building) or at distance surgery, but related to it.
- Inflammatory - ARTERITIS Takayasu, a nonspecific inflammation, of unknown etiology may lead to formation of aneurysms and dissection. Also nonspecific aortitis, al, or specific luetic may develop subsequent aneurysms and dissection.
- Toxic, a new etiological class is associated with aortic dissection and amphetaminelor toxic effect of cocaine on the aorta.

7. 2. Classification of aortic dissection.
Aortic dissection is classified according to anatomical location, expansion, development time and complications.
- Classification De Bakey - four types (Fig. 1.)
  • Type I - dissection affects ascending aorta, aortic arch and descending aorta. Entry gate is located on the ascending aorta. Dissection process may spread distally but also proximally to the aortic valve and coronary ostia, causing acute aortic regurgitation with or without dissection of coronary ostia and myocardial infarction. It represents about 70% of total cases of dissection.
  • Type II - It affects only the ascending aorta without aortic arch enlargement.
  • Type III A – is located on thoracic descending aortic dissection only, without extending to the abdominal aorta.
• Type III B – is located on the thoracic descending aorta and extending to the abdominal aorta.

Figure 1. DeBakey classification of dissection Figure 2. Stanford classification

- Stanford classification. It is a simple classification in two types (Figure 2)
  • Type A - Dissection affects the ascending aorta and may extend to the aortic arch and descending aorta.
  • Type B - affects only the descending aorta.
  - New classification -
    • Class 1 - classic aortic dissection, flap between false lumen and true lumen.
    • Class 2 - Disruptive media forming a parietal hematoma
    • Class 3 - reduced dissection without hematoma, only an eccentric swell at the site of intimal injury.
    • Class 4 - ruptured atherosclerotic plaque, ulcerative plaque with subadventitial hematoma.
    • Class 5 - iatrogenic or posttraumatic dissection.

Depending on the time of diagnosis, immediately after dissection or late, the dissections may be acute and chronic.

7. 3. Acute clinical manifestations of aortic dissection

Onset of aortic dissection is brutal, dramatic, with intense chest pain and possible death immediately. Signs and symptoms are typical aortic dissection (Table I)

Table I. Acute signs and symptoms of aortic dissection

- Chest pain
- The major symptom
- Associated with syncope
- Associated with acute heart failure
- Associated with stroke
- Acute heart failure
- Stroke
- Acute myocardial infarction
- Acute peripheral ischemia
- Mesenteric ischemia

- Pain - is a major symptom to be analyzed, the onset, location, intensity, radiation, change in time and associated symptoms.
  Onset is sudden pain in the dissection, sharp stabbing character, with maximum intensity at first. Location is retrosternal and interscapular ascending aorta to dissection in the descending aorta of. Two characteristics of pain in pain we can switch to a process of dissection;
  - Which is the maximum intensity at onset and then gradually reduce
  - Simultaneous or sequential occurrence in other areas
  Simultaneous occurrence of acute pain over and subdiafragmatica intense need to suspect a process that extensive dissection of the aorta.
  - The combination of symptoms and neurological signs (syncope, paraplegia, coma) - with the onset of pain, trunk show impaired blood flow supraaortice by the dissection.
  - The emergence of phenomena of acute heart failure - may be on the extension process to root aortic dissection with aortic valve detachment and acute aortic Enough with or without affecting the coronary and myocardial infarction armies.
  - Acute visceral ischemia and peripheral - can be misleading sign of onset in 10% of cases of dissection in the dissection that can fold axis obstruction Vascu important iliac, celiac trunk, renal a., femoral, rarely axillary arteries with ischemic events in the territorial affected.

**Clinical examination of the patient**

History highlights a patient deobieci man in the sixth decade of life with a history of uncontrolled hypertension medication, with possibly other cardiovascular risk factors, smoking, diabetes, hypercholesterolemia, obesity or genetic disorder known as Marfan syndrome, Ehler-Danlos syndrome.

Most patients have elevated blood pressure examination, are anxious. 20% of cases we have objective signs of hypovolemic shock with cardiac tamponade in case of rupture in the pericardial sac. Assessment of peripheral pulses in all locations can access highlights inequality or lack of pulse. This outbreak of a blast listening to the diastolic aortic, aortic regurgitation may detect a recently installed. This sign of cardiogenic shock with decreased cardiac performance can occur with myocardial damage subsequent coronary armies.

**Differential diagnosis.** The disease is having a similar onset, with pain, acute myocardial infarction, pulmonary embolism, acute aortic regurgitation from other causes,
pericarditis, acute musculoskeletal pain, pleuritis, acute cholecystitis, perforated ulcer, heart enteromezenteric. History properly conducted clinical examination and paraclinical objective are those that cut diagnosis.

7. 4. Diagnostic algorithm of acute aortic dissection

If a patient with suspected aortic dissection, management is divided into diagnostic and therapeutic measures immediate and complex investigations in cases with hemodynamic stability and need for additional information.

A) Immediate measures in the emergency room.
To guide the diagnosis by clinical examination and echocardiography for confirmation from the suspicion of dissection (Table II.) And the establishment of the first therapeutic measures to decrease blood pressure, pain and anxiety.

Table II. Immediate measures in the emergency room

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• Anamnesis thorough, complete examination, BP, pulse distal
• ECG, chest X-ray.
• Installation of peripheral venous lines, blood tests, blood group, Rh, CK, Ht, Hb, urea, creatinine
• Decrease pain by administering morphine.
• The decrease in systolic BP of 100 mmHg values, beta blockers (IV. Propranolol, metoprolol, esmolol)
Transthoracic and transesophageal echocardiography • Making
• Notification Service Intensiva therapy and cardiovascular surgery about a possible emergency surgery.

________________________________________________________________________

In hemodynamically unstable patients, immediate attitude is different, the patient was intubated and ventilated place a central venous line, arterial line pressure monitoring bleeding, ECG monitoring. Transesophageal echocardiography performed in emergency, can the diagnosis is aortic dissection, complicated by cardiac tamponade, acute left ventricular rupture Enough valve or myocardial infarction caused by dissection. It said the cardiovascular surgical service and the patient is rushed to the operating room.

B) If the patient determine hemodynamic.
Diagnostic procedures may continue for confirmation of diagnosis, setting type A or B dissection, identify the entrance gate, tear intimate appreciation of the aortic valve and ventricular function, assessment supraortice vessels (Table III)

Table III. Investigations in acute aortic dissection.
- Chest X-ray - routinely done in all patients, face and profile, is abnormal in 80-90% of patients, first amendment mediastinal shadow (Fig. 3).

Figure 3. Ascending aorta and aortic arch dissection, 46 years. E.B.M., (Institute of Cardiovascular Diseases - Timisoara).

Other radiographic signs, the progressive widening of an examination to another aortic silhouette, image bilobulată are less common, but very suggestive. Also, viewing a private calificicări in parietal contour is very characteristic aortic dissection ("calcium sign").

- Transthoracic and transesophageal echocardiography - is the first investigation diagnosis can be made by emergency emergency room, operating room, without prior preparation and with high sensitivity and specificity (Table IV).

Table IV. To the TEE data, confirming and establishing the type of aortic dissection.

- Confirm diagnosis by identifying the dissection flap
- Identification of two channels, one false and one true expansion ascending aorta, aortic arch, descending aorta, gate, gateway, communication between the two channels, false lumen thrombosis
- Presence or absence of acute aortic regurgitation
- Findings of left ventricular function, ejection fraction, left ventricular hypertrophy
- Presence or absence of pericardial fluid, quantity, hemodynamic effect
- Identification of periaortic hematoma, the hematoma intramural

Sensitivity of TEE in the case of an experienced explorationist is up 99% and specificity reached 90% (Figure 4).
Figure 4. Transesophageal echocardiography in demonstrating value, intramural hematoma, dissection flap of the aortic arch, descending aorta. (Dr. Adina Ionac Institute of Cardiovascular Diseases, Timisoara)

A small portion of the ascending aorta and aortic arch to the front, it is difficult to visualize ultrasound, trachea and bronchi due interpozitiei left, bearing the name of "Blind Spot". TEE is superior to conventional CT and aortografiei and have made the first investigation in all patients suspected aortic dissection. ETE limits appear in major branches supraaortice assessment. For additional information spatial resolution of the aorta completely, if the patient's condition permits, is spiral CT scan, MRI with contrast material.

- Computed tomography - CT-conventional investigation is very limited due to artifacts produced by cardiac structures in motion. Intoducerea spiral CT has greatly improved the quality of information made, making this method a valuable diagnostic investigation of preoperative and postoperative outcome (Table V).

Table V. Information to Computed Tomography

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<td>- Confirm diagnosis by identifying intimate flap that separates the two lumens.</td>
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<td>- Determines the size of the aorta at different levels, this periaortic hematoma, the break of pericardial, pleural</td>
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<tr>
<td>- Rate supraaortice state large vessels, the dissection flap</td>
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<tr>
<td>- While tracking the evolution of postoperative false lumen, thrombosis, aneurysms develop postdisectie.</td>
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<tr>
<td>- Value aprecierea reduced aortic regurgitation, rupture discreet intimate.</td>
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Sensitivity of the method is 85-95% and specificity of 87-100%.

- Magnetic Resonance Imaging (MRI) - is a modern method of sensitivity and specificity greater than TEE and CT (Table VI). Identifying vessels and surrounding structures.
Table VI. Magnetic Resonance Imaging

- Confirmation of diagnosis with high accuracy
- Information about the aorta, large vessels and surrounding structures
- View the parietal hematoma, flap female periaortic hematoma
- Image is tridimensional, and studying the relationship of the aorta with surrounding structures
- Combining magnetic resonance imaging with contrast material resonance is ideal aortic anatomy study.
- View even hostile crown, if they are affected by the dissection process.
- Rate and state appliance and valvular aortic cavity and cardiac function.
- Very useful in tracking the evolution of postoperative dissection.
- Study of chronic dissection

Accuracy of the method Sensitivity and specificity approaching 100% in all forms of dissection except very limited, subtle (grade 3). Can be performed in emergency, even in experienced centers intubated patients, even before TEE.

- Aortografia and coronary angiography - With the advent of new noninvasive diagnostic methods that, TEE, CT scan, MRI, has moved from position aortografia indispensable investigation confirm a diagnosis in the assessment method the surgeon and interventionist cardiologist (Table VII). However information system to the coronary status (which may be associated stenotice lesions), large vessels supraaortice assessment (Figure 5) and therapeutic value in some situatii as fenestratia or placement of stents, to keep a valuable arsenal of diagnostic and therapy.

Table VII. The diagnostic value and Coronarografiei Aortografiei

- Findings of the coronary system, aortic regurgitation
- View intima flap, intraluminal aortic irregularities,
- Locating the origin of dissection
- Findings supraaortice trunk, abdominal vessels (mesenteric, renal) and peripheral ischemia in case of very useful peripheral.
- Presence of fistula, rupture of the aortic root and pericardial cavity, cardiac cavities, pulmonary artery.
Figure 5. Aortografia who appreciate supraortice vessels, normal in the first case (pac.BR, 22 years) subclavicular artery occlusion and straight, with acute upper limb ischemia (pac. MM, 62 years) (Institute of Cardiovascular Diseases, Timisoara)

Intravascular Ultrasound (IVUS) - Is a new published method with sensitivity and specificity of 100%, consisting of vessels through a catheter study - transducer to collect data directly from the vessel lumen. Flap identify intimate true lumen and the false, the relationship between them, communication, thrombosis, parietal hematoma, impaired arterial branches. Precisely identify the mechanism of compression of the aortic branches (dissection that affects the origin or segregation ostiumul narrow the origin of these vessels by dissection and their obstruction the flap. It is particularly useful in therapy gidarea intraluminal stent placement.

7.5. Natural evolution and prognosis of aortic dissection.

Aortic dissection is one of the most severe pathological entities prognosis, contributing a significant proportion of cardiovascular mortality. Its prevalence is estimated at 0.5 to 2.9 / 100,000 / year, with a mortality of 3.2 to 3.6 / 100,000 / year. After 50 years without surgical intervention, mortality was 20% in the first 24 hours, and at one month supravetuirea was 8% and 2% a year. Early mortality in the first 24 hours of natural evolution is 35% and continues to be built in the early days and first two weeks. Thus 50% die within 48 hours, 70% in the first week, the percentage increasing to 80% in the first two weeks (Anastopoulus). This hypotension, the cardiac tamponade is a severe prognostic sign. A group of 500 patients with aortic dissection type A, which were not treated, 21% die within 24 hours, 37% in 48 hours, 72% in two weeks, 90% in three months. Complications of aortic dissection are, aortic rupture with cardiac tamponade, coronary dissection armies myocardial infarction, acute aortic Enough, shock stroke by
supraaortice trunk obstruction, visceral ischemia, acute peripheral ischemia.

7. 6. Algorithm therapeutic medical, surgical and intervention of acute aortic dissection

Acute aortic dissection is a major emergency cardiovascular surgery, which deals with a complex team, cardiologist, cardiovascular surgeon, interventionist cardiologist and anesthesiologist. Any suspicion of aortic dissection is sent by the general physician, cardiologist in the territory, or guard service to a specialized center for cardiovascular surgery, which is announced in advance by telephone.

Setting prioritatilior of patient hospitalization
• Emergency positive diagnosis and accurate form of dissection
• Immediate investigations, BP, ECG, chest X-ray, Echo transthoracic / transesophageal
• Peripheral intravenous line, assessment of urgency, blood group, Rh, Ht, Hb, CK
• Lowering high blood pressure (beta blockers), analgesics,
• Announcing the cardiovascular surgical team, cardiac surgeon, anesthesiologist, cardiologist interventionist.
• Monitoring, BP, ECG, blood pressure bleeding, PVC, diuresis, neurological, blood gases.
• Hemodynamically unstable patients with signs of cardiac tamponade are intubated and ventilated emergency being taken to the operating room with ecotransesofagian as the only diagnostic investigation.
• In case of hemodynamic stability and the assessment of cardiovascular surgical team, to broaden investigations, CT scan, MRI, Aortografie and coronary angiographic, IVUS.

Surgery and / or Interventional depend on the type of dissection, localization, extension, complications, and evolving team experience. The goal of surgery in type A Stanford (type I, II, DeBakey) aortic rupture is imminent to prevent the weakening of the wall, and the development of cardiac tamponade, as well to solve acute aortic regurgitation or coronary compression armies.

Definite indications of surgical treatment
• Acute Type A Dissection phenomena of cardiac tamponade, or type B with massive pleural effusion or spinal neurological phenomena.
• type A dissection, with or without acute aortic regurgitation, with or without affecting coronary armies.
• type A dissection with compression on the flow of logs supraaortice dissection
• aortic aneurysms occurring in time after untreated chronic evolution of acute dissection, having a size exceeding 4 cm in diameter, regardless of location.
• Dissection Acute aortic aneurysms occur in the matter of location, the imminence of rupture.
• aortic Dissection in Marfan syndrome.
• Dissection aortic type B, the descending aorta is complicated by visceral ischemia or imminent rupture or fissure with pleural effusion satng.

**Interventional treatment**

There are two ways to address technical aortic dissection, Interventional;
• intraaortice stent placement, especially in the descending aorta in type B to racie, but even in the aortic arch by placing stents tees on all three trunks supraortice, patients in serious condition.
• Engineering fenestratie - for obstruction of visceral arterial trunks by compression of the false lumen. So using a catheter lumen is really fenestreaza from (lowest), to the fake, near major collateral (a. kidney, mesenteric, iliac) to restore blood flow in these branches.

**Conservative treatment**

• In case of aortic dissection type B, uncomplicated
• aortic arch dissection limited, uncomplicated
• associated comorbidities are high risk, patient refusal
• stabilized chronic dissection, the false lumen thrombosis without aneurysm development.

**7. 7. Surgical techniques**

All types of acute aortic dissection is approached by the cardiovascular surgeon by check through the femoral or axillary artery for Tubular perfusion pressure, venous drainage only through the cannula into the right atrium, in hostile cardioprotective Anterograde coronary and coronary sinus, pulmonary vein vent or apical and consists in replacing the segment that contains the gateway to tear intimate with a Dacron prosthesis and restoration of blood flow in true lumen.
• type A aortic dissection, ascending aorta located only with aortic valve and coronary-free communion wafers - replace only the ascending aorta to aortic arch with a Dacron tubular prosthesis (Fig. 6). It is the most simple.
Figure 6. Proximal and distal suture line is reinforced by the application of GRF (glycerol resorcina formaldehyde) to solidify the parietal layers, or with no strip of Teflon on the inside and outside

- type A aortic Dissection extended to the aortic root with aortic valve damage (Fig. 7).
  - Aortic valve prosthesis is tubular pellet +
  - To repair the aortic valve tube technique David Tiron
  - Dissected aortic root replacement with graft Conduct engineering and benthos,
    Conduct mechanical or biological (Freestyle, Homogrefa).

Figure 7. Resuspensia comisurii Prolab. Application of GRF in the dissection. Surjet the distal segment. Interpoziția tubular prosthesis, is the last stage.

- aortic Dissection with compromised coronary armies - armies permeability restoration through application of GRF + tubular prosthesis on ascending aorta. (Fig. 8.)
Figure 8. Repair of coronary armies with GRF and suture line to reinforce the anastomosis surjet

• Dissection of coronary lesions associated with acute aortic - has been linked bypass graft (Fig. 9.)

Figure 9. Association of aorto-coronary bypass

Total circulatory stop in deep Hypothermia anterograde or retrograde cerebral protection.

To resolve lesions in the aortic arch was required intensive clinical and laboratory studies on best practices for protecting brain function during cerebral circulation when it stops. The current practice of total circulatory cessation method, 15-60 minutes in deep hypothermia (cooling of the patient from 37-18 * C), and administered by antegrada (A carotid) or retrograde (superior vena cava) of an infusion minimal maintenance of a resting brain metabolism, to avoid irreversible damage.

Using this technique can replace part or in whole aortic arch with reimplantation trunk supraaortice interpozitie the hearing directly or tubular (Fig. 10)
Dissection extended to the descending aorta can be solved in the same surgical time, when replaced ascending aorta, aortic arch, and left a hearing on "elephant trunk" in the descending aorta, Borst technique or a stent placed intraoperatively in the descending aorta (technique in Vienna).

7. 8. Postoperative complications. Results.

Postoperative complications may occur, bleeding, neurologic, cardiac output syndrome low acute renal Enough, Enough respiratory infections. With all the progress made postoperative mortality barely fell below 15% in most centers performing cardiac surgery, and morbidity is still high. But that compared with natural evolution process of dissection and the results of 20 years ago is very good. Should be intensively treated patients operated on for removal of cardiovascular risk factors, smoking, blood pressure control, diet, reduce fat levels and should regularly follow echocardiography and CT, for the evolution of aortic dissection outstanding segments. Sometimes it is required reintervention, which is more difficult and increased mortatlitate.