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Aorto-enteric fistulas: A physiopathological approach and computed tomography diagnosis

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Abstract Infection of an abdominal aortic prosthesis with an enteroprosthetic fistula is a very serious, life-threatening complication, leading sometimes to severe functional consequences, the most serious being amputation. Since the symptoms, if there are any, are often rather non-specific, diagnosis is frequently difficult and has always to be based on a whole series of justifications. Early diagnosis is essential and this fistula should be the first possibility considered in a patient with an abdominal aortic prosthesis who is presenting rectorrhagia or melaena (even if only to a slight degree), sepsis and/or abdominal pain. Although rare, the clinical existence of hypertrophic osteoarthropathy may assist diagnosis. A CT scan is the examination of choice, the criteria providing evidence of a fistula being the presence of gaseous images in a periprosthetic fluid collection, thickening and/or retraction of the intestinal walls in contact, the existence of a false aneurysm, and finally, very rarely, extravasation of contrast agent into the intestinal lumen. The differential diagnoses that may mimic a fistula need to be well known, and can include retroperitoneal fibrosis, an infectious aneurysm, inflammatory or infectious aortitis, and above all, a 'simple' prosthesis infection without fistulisation.

An aorto-enteric fistula may be primary or secondary. In the vast majority of cases, a primary fistula, the rarer (only 250 cases described in the literature [1]), complicates a pre-existing aneurysm. Secondary fistulas are far more common. They occur as a sequel to surgery for an abdominal aortic aneurysm with or without implantation of a prosthesis, more commonly during open surgery than when an endoprosthesis is implanted by the endovascular route. Infection of a synthetic prosthesis with an aorto-enteric (or enteroprosthetic) fistula is a serious complication. Its seriousness is related to the life-threatening consequences (mortality near 50%, and up to 100% if not treated), the functional

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consequences (amputation in 30% of cases), and to the underlying infection, itself correlated with the degree of involvement of the prosthesis and the anastomoses. These secondary fistulas may appear 2 weeks to more than 10 years after the surgery. The existence of an abdominal aortic prosthesis infection is sometimes even revealed by clinical signs of hypertrophic osteopathy, which need to be recognised. It must therefore be remembered from the outset that diagnosing an aorto-enteric fistula is difficult, but should always be the first possibility envisaged in a patient with an abdominal aortic prosthesis who presents even the slightest rectorrhagia or melaena, abdominal pain and/or sepsis.

Basic clinical facts

Infection of a vascular prosthesis is rare, involving between 0 and 6% of prostheses. Its frequency depends on the site of implantation: for a strictly intra-abdominal prosthesis, this is 0.4 to 0.7%. The risk increases as the femoral triangle is approached, and is greatest for axillofemoral bypasses, at 5 to 8%, firstly because some of the subjacent terrain has often been weakened, and secondly because this type of bypass is still one of the methods of treating aortic prosthesis infections. Early infections (less than 4 months after implantation) must be clearly distinguished, by their strange physiopathology, from late infections, which occur more commonly (70 to 85% of cases).

The clinical presentation of aorto-intestinal fistulas is very variable, with acute or chronic, massive or slight intestinal haemorrhage, and this diagnosis should also be considered when confronted with prolonged fever or abdominal or lumbar pain in a patient with an aorto-iliac or aortofemoral prosthesis. Brutal, massive haemorrhage is often preceded by more restricted episodes of bleeding (*herald bleeds*).

Therapeutic management needs to combine antibiotic therapy with a surgical procedure. Specific features are required of the antibiotic therapy, which may otherwise not be very effective due to the mass of fibrin and platelets, the poorly vascularised environment and the high bacterial inoculum protected by a biofilm (cf. Basic physiopathological facts): it is essential to associate two or three high dose antibiotics; in the case of an aorto-enteric fistula, it is necessary to cover anaerobic organisms; the length of treatment is at least 6 weeks IV, then 6 months oral administration (even for life, according to certain authors). Surgical treatment must observe the following rules:

- the extent of the infection must be precisely determined by dedicated imaging and, if necessary, by surgical exploration;
- the causal micro-organism must be identified;
- if one of the anastomoses is involved the infected prosthesis must be totally ablated.

Various surgical options can then be offered:

- total ablation of the prosthesis with implantation of an extra-anatomical bypass (in the same procedure or at a later time);
- simple ablation of the prosthesis with no revascularisation;
- replacement of the prosthesis in situ (using a polyester prosthesis impregnated with rifampicin, an allograft or autograft);
- retaining the prosthesis;
- finally, and extremely exceptionally, endovascular treatment [2—7].

Basic physiopathological facts

Abdominal aortic prosthesis infections

Intestinal commensal micro-organisms (anaerobic enterococci) are responsible for a major proportion of intra-abdominal infections. *Staphylococcus epidermidis* (and more and more frequently *Staphylococcus aureus*) is the prime offender as concerns aortofemoral reconstruction. Pseudomonas and other Gram negative bacilli are increasingly emerging. The time to appearance and the clinical aspects of prosthesis infection depends on the micro-organism:

- in the event of early infection (< 4 months), the bacteria incriminated, such as *S. aureus* are very virulent. General and local signs of infection are considerable and cultures often positive. Gram negative bacilli (Pseudomonas and Proteus) may more rarely be the cause;
- later infections on the other hand are caused by much less virulent micro-organisms, capable of producing a biofilm (slime) protecting them against the body's defences and antibiotics. They are nearly always caused by *S. epidermidis*. The biofilm is an organised system of layers of microbial cells and extracellular polymers on a surface. These micro-organisms therefore stay quiescent for a long time, and the infection develops gradually, possibly becoming symptomatic only months (or even years) after implantation. Enterobacteria can also cause late onset infections, in particular when there is an aorto-intestinal fistula or blood borne contamination [3].

Primary aorto-enteric fistula

A *primary* aorto-enteric fistula is a communication between the native aorta and an adjacent intestinal segment in a patient who has never undergone surgery or suffered prior trauma. It is usually a complication developing from an atheromatous aneurysm of the abdominal aorta. Much more rarely, it may be related to an infectious ('mycotic' [8]) aneurysm, vasculitis, tuberculosis or lastly, and historically, syphilitic aortitis [1,9—11].

Secondary aorto-enteric fistula

A *secondary* aorto-enteric fistula is a communication between the aorta and an adjacent intestinal segment in a patient who has previously had aortic surgery, with or without insertion of a prosthesis. It is generally the ultimate complication developing from a chronic aortic prosthesis or endoprosthesis infection, which explains why abdominal prosthesis infections and aorto-enteric fistulas share many radiological signs and appearances and are often quite difficult to detect. In 80% of cases, the fistula