TREATMENT OF VASCULAR PROSTHESIS INFECTIONS
– 15 YEARS OF EXPERIENCE

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The aim of the study was to present the results of treatment for vascular prosthesis infections.

Material and methods. From January 1993 until January 2008, 47 patients were treated at Department of General and Vascular Surgery Bródnowski Hospital due to symptomatic, late vascular graft infections. The most common local symptoms were groin abscesses, often with bleeding complications. All patients with diagnosed vascular prosthesis infections were treated operatively.

Results. Fifty-three operations were performed, resulting in the regression of infection symptoms in 17 cases (63%), with 37% of cases leading to amputation. Mortality in the patients examined amounted to 37%; 46.4% of cases displayed recurrent infection. The period of hospital treatment oscillated between 12 to 221 days (av. 74 days).

Conclusions. 1. Aggressive operative treatment of vascular prosthesis infections is burdened by high percentages of recurrence and amputation. 2. Less radical operative treatment techniques yield similar results. 3. A uniform protocol for diagnosed vascular prosthesis infection is currently lacking.

Key words: infection, vascular prosthesis, limb ischemia

The introduction of synthetic vascular prostheses heralded a new phase of arterial surgery. Use of this technique facilitates the application of more complex circulation-reconstructing procedures. In the last 20 years, artery surgery has made enormous progress: new operative techniques have been introduced and minimally invasive endovascular methods of treatment have been invented. The results of operative treatment for artery diseases are still improving. Due to the increasing number of arterial operations, the number of postoperative complications connected with the application of synthetic grafts is increasing. Infections are said to be the gravest complications in arterial surgery: in such cases, mortality may reach 90% and the percentage of amputations may approach 30-50%. Unfortunately, in case of vascular prosthesis infections, unsatisfactory treatment results have been observed for years. In spite of using antibiotic prophylaxis, as well as various methods of surgical intervention, the percentage of infections has not improved over the last 10 years, oscillating between 1 and nearly 15%. Over 50% of infections occur late, often many months after the surgical procedure. Initially, local symptoms are rarely observed, but then general symptoms and septic hemorrhage develop. Due to unsatisfactory treatment results, a uniform protocol for the treatment of diagnosed vascular prosthesis infection is currently lacking.

In this paper, we aim to present our experience gathered during 15 years of treatment for late vascular prosthesis infections.

MATERIAL AND METHODS

At our department, 47 patients were treated between January 1993 and January 2008 due to symptomatic late vascular graft infec-
tions. The group of patients comprised patients who were originally operated upon at our center (21 cases) as well as patients sent from other centers (26 cases). The group consisted of 10 women and 37 men. Their age varied between 46 to 83 years (av. 61.4 years of age).

The inclusion criteria were:
- occurrence of symptoms more than 30 days after the primary vascular surgical procedure,
- clinical symptoms of vascular graft infection, evaluated according to Shilagayi’s or Samson’s and Wright’s criteria [grade III of infection progression according to Shilagayi (10), grade III-V according to Samson and Wright].

The most frequently observed local symptoms of infection were inflammatory infiltration of the groin (12 patients, 25.5%), purulent groin fistulas (14 patients, 29.8%) and septic bleeding from purulent fistulas (12 patients, 25.5%). In 5 cases, we diagnosed purulent fistulas with anastomotic separation in the groin and development of an infected false aneurysm as a complication (10.6%). In 4 cases (8.5%), a fistula between the upper anastomosis of a Y graft and the duodenum was diagnosed, with symptoms of massive hemorrhage from the upper alimentary canal. General symptoms were usually scant: increase in body temperature to 38°C in a period prior to the opening of groin fistulas was observed in 4 patients; the slow production of local ischaemia leading to a hemoglobin level of 8.5 mg% was noted in 5 patients.

In the cases examined, the symptoms of infection occurred within 35 to 75 months after implantation of the vascular prosthesis (18 months on average).

All the patients were originally operated upon as planned, due to chronic lower limb ischemia (43 cases) or an abdominal aortic aneurysm (4 cases). A comparison of the original procedures used to reconstruct the circulation is presented in tab. 1.

Imaging diagnostics were performed with the patient in an ambulatory state in 37 cases. Doppler ultrasonographic imaging was chosen as the basic technique for these examinations and was performed in all cases. Doppler ultrasonographic imaging confirmed the symptoms of infection (e.g., presence of dense liquid cisterns near the anastomosis, purulent fistulas). In patients with few symptoms or if ultrasonographic examination did not unequivocally confirm infection, an angio-CT examination was performed (10 cases). In 10 cases with septic hemorrhage as a dominant symptom, patients were admitted and operated upon urgently, with intraoperative diagnosis. Bacteriological diagnostics included cultures of the infected material, taken ambulatorily from patients with purulent fistulas. In the remaining cases, cultures were obtained during the surgical procedure.

Patients were admitted and prepared for surgery according to the accepted protocol (fig. 1).

The planned operations were performed in 37 (78.7%) cases; in 10 patients (31.3%) with septic hemorrhages, patients were operated upon urgently. In each case, the method of operative treatment was chosen individually, depending on the situation found at the inflammatory focus.

We operated upon four patients (8.5%) with a fistula between the upper anastomosis of a simple prosthesis and the duodenum. In 2 cases (4.2%), vascular anastomosis was reconstructed with irrigation drainage, resection and suture of the fistula opening within the duodenum. In the remaining two cases, a vascular prosthesis was exchanged, supplying the area of the intestinal fistula and separating the prosthesis from the duodenum and surrounding tissues.

In 25 (53.2%) patients with infection in the area of the groin anastomosis, we performed ablation of the infected prosthesis or related

<table>
<thead>
<tr>
<th>Kind of operation</th>
<th>Number of patients</th>
<th>%</th>
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<tbody>
<tr>
<td>Prosthesis Y grafting due to Leriche syndrome</td>
<td>26</td>
<td>55.3</td>
</tr>
<tr>
<td>Aorto-femoral graft</td>
<td>8</td>
<td>17</td>
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<tr>
<td>Abdominal aortic aneurysm – prosthesis Y</td>
<td>2</td>
<td>4.2</td>
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<tr>
<td>Abdominal aortic aneurysm – a simple prosthesis</td>
<td>2</td>
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<tr>
<td>Iliac-femoral graft</td>
<td>5</td>
<td>10.6</td>
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<tr>
<td>Femoral-femoral graft</td>
<td>1</td>
<td>2.1</td>
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<tr>
<td>Femoropopliteal PTFE graft</td>
<td>2</td>
<td>4.2</td>
</tr>
<tr>
<td>Femoropopliteal venous graft</td>
<td>1</td>
<td>2.1</td>
</tr>
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Total | 47 | 100 |
Fig. 1. Algorithm of proceedings in cases of vascular prosthesis late infections

Diagnostics:
Clinical evaluation
Laboratory investigations
Evaluations of progression and extensiveness of the infection: USG, NMR, CT, fistulography etc.
Microbiological investigations: inoculation and antibiogram

Preparing for an operation:
General qualification (preoperative internal and anesthesiologic evaluation)
Compensation of possible morphologic, electrolytic, protein deficiencies
Introduction of guided antibiotic therapy 3-5 days before the operation

Selection of the operative technique: individual selection according to evaluation of the patient’s state, local state and technical means.
The safest operation possible.

Ablation of the graft, concurrent extra-anatomical Gore-Tex graft
Ablation of the graft, primary amputation
Debridement + irrigating drainage, ev. complete covering graft with pedunculated muscle flap
Ablation of the graft, in situ graft (Gore-Tex, venous intermediate lamella, allograft, antibiotic bonded prosthesis, silver-coated prosthesis)
Ablation of the graft, delayed reconstruction after the infection is controlled
Ablation of the graft + simultaneous reconstructive operation: concurrent extra-anatomical graft, in situ graft (Gore-tex, venous graft or homograft)

Fragment, without reconstructing the circulation in 11 patients (44%); ablation of the infected prosthesis with a concurrent extra-anatomical Gore-Tex graft in 3 patients (12%); created irrigating drainage without ablating the infected graft in 6 patients (24%); and covered the infected prosthesis with a pedunculated muscle flap in combination with drainage in 5 patients (20%).

In patients with infected false aneurysms, the aneurysm was resected with an intermediate lamella made of Gore-Tex prosthesis (2 cases, 50%); with an intermediate lamella made of silver prosthesis (1 case, 25%); and finally, in 1 case (25%), the arm of the prosthesis was ligated at a high level, without secondary reconstruction and with a concurrent amputation at the thigh level. In this last case, we concurrently diagnosed critical limb ischemia, without anatomical conditions that allowed for by-pass.

In 14 cases (29.8%), symptoms of recurrence of infection were observed at the site of the operation. They appeared within 30 days to 24 months after the first intervention in the infected area. In these cases, patients were submitted to an additional surgery involving the application of more radical surgical techniques. Due to further recurrent infections, the number of interventions oscillated between one and five in particular cases. Twenty-six re-operations were performed: ablation of the prosthesis or its infected fragment without reconstructing the circulation in 8 cases (57.1%); ablation of the infected prosthesis and concurrent extra-anatomical Gore-Tex graft in 4 patients.
(28.6%); irrigation drainage in 8 patients (57.1%), ablation of the infected fragment of the prosthesis with a venous intermediate lamella “in situ” in 4 patients (28.6%). The purulent prosthesis was ablated in 2 cases and exchanged “in situ” with an allograft, prepared according to the cold ischemia protocol at 4°C.

RESULTS
In microbiological examinations, we most often identified the following etiological sources of infection: Staphylococcus (S. aureus in 48%, S. epidermidis in 15%) and (Enterococcus faecalis) (11%). When strains of Staphylococcus aureus was present, MRSA strains were identified in 12 (25.5%) patients. This pattern suggests an intra-hospital infection.

When infection symptoms occurred for the first time, the following treatment results were obtained:

– of those patients with fistulas between the upper anastomosis of a simple prosthesis and the duodenum, 3 patients (75%) died. One died during the operation pursuant to the appearance of circulatory insufficiency symptoms; the other patient died in the third twenty-four hours after the operation after exhibiting multiorgan insufficiency symptoms. Both patients belonged to the highest-risk group (above 35 points according to the APACHE II scale); they were operated upon due to life-threatening symptoms on an urgent basis. One of the patients, without recurrent symptoms of infection at the site of the operation, died in the 36th month after surgery due to cardiac complications;

– among patients who underwent ablation of the infected prosthesis or its fragment without the reconstruction of circulation, regression of purulence symptoms were noted in 8 (73%) patients (due to critical limb insufficiency symptoms, early amputation was performed for three such patients); recurrent infection was observed in 1 (9%) patient; 2 patients died during the postoperative period due to cardiac complications (18%);

– with regard to those patients that underwent ablation of the infected prosthesis with a concurrent extra-anatomical Gore-Tex graft, 1 patient without recurrence of infection symptoms is under ambulatory observation; 2 patients (67%) required graft ablation due to early symptoms of recurrent infection in the extra-anatomical graft and septic bleeding. Increasing symptoms of critical insufficiency resulted in limb amputation in both cases; 1 death was noted (33%);

– among the patients that required irrigating drainage, 1 (16.7%) patient without recurrent infection symptoms is under ambulatory observation. After clinical regression of infection symptoms of varied duration (from 1 to 24 months), infection recurrence was observed in 6 (100%) patients. One patient died with septicemia symptoms;

– in some patients, we covered the infected prosthesis with a pedunculated muscle flap in combination with drainage: 1 (%) patient without recurrent infection symptoms is under observation; recurrence was observed in 2 patients (67%) with symptoms of a generalized infection.

In general, regression of infection symptoms was obtained in 11 (44%) patients in this group (including 5 cases of limb amputations).

Infection symptoms recurred in 14 cases (29.8%). Six patients died (42.9%). Recurrence of clinical symptoms of infection in patients who did not have their prostheses ablated occurred within 14 days to 24 months after the operation (the period when patients were free of infection symptoms was 6.5 months, on average).

The following results were obtained for the treatment of recurrent infection:

– ablation of the infected prosthesis or its fragment without the reconstruction of circulation: regression of infection in 6 patients (amputation was needed for 2 of them), one recurrent infection in the segment of the left prosthesis; death of 1 patient;

– ablation of the infected prosthesis with a concurrent extra-anatomical Gore-Tex graft: regression of infection in 2 cases, recurrence in 2 patients (the Gore-Tex intermediate lamella was ablated in both cases, one of which required amputation);

– irrigating drainage: infection was controlled in 1 patient, recurrence was observed in 7 cases;

– ablation of the infected fragment of the prosthesis with a venous intermediate la-
mella in situ: infection was controlled in 2 patients, amputation was performed in 1 patient (who remains alive), 1 patient presented recurrent infection; – ablation of the purulent prosthesis with application of an allograft: amputation in 1 patient, which involved 1 death (in both cases, the allograft ruptured in the first twenty-four hours after the surgical procedure).

To sum up, the following results were noted in treatment of recurrent vascular prosthesis infections: regression of infections was obtained after 11 operations in 6 (42.9%) patients; limbs were amputated in 5 (35.5%) patients; 6 (42.9%) patients died. The percentage of repeated recurrences was 42% (after 11 operations).

Operative treatment of vascular prosthesis infections led to the performance of 73 surgical procedures. The following results were obtained:

Regression of infection traits in 17 (68%) patients, with 10 (40%) amputations and 14 (56%) deaths. Recurrences were observed in 56% of patients.

The hospitalization period varied between 12 to 221 days (74 days on average).

**DISCUSSION**

Infections are considered to be the most important problem related to vascular surgery. In view of the increasing population of patients with vascular grafts, infection of vascular prosthesis concerns a broad group of vascular surgeons. Patients presenting with non-specific symptoms are often admitted to a general practitioner or to consultants in other specialties who are not always capable of assessing the importance of rare symptoms, which may delay the initiation of proper treatment.

Infections are currently the main reason for failure in the surgical treatment of vascular diseases: if infection is diagnosed, perioperative mortality rates range from 10 to nearly 50%; the percentage of amputations ranges from 30-50%. Despite the use of antibiotic prophylaxis and aseptic protocols, the percentage of infections in the last decade has not diminished and ranges between 1 and nearly 15%.

The microorganisms isolated most often in cases of late infections of vascular prostheses are Staphylococcus epidermidis, Staphylococcus aureus and Candida albicans. The bacterial profile was similar in the material we examined, whereas the percentage of mycotic infections was significantly lower – only one such case was confirmed. Research conducted recently in Poland proved that during the insertion of grafts, a primary colonization of cutaneous pathogens affects nearly 40% of vascular prostheses. In most cases, a small concentration of *Staphylococcus* colonies was observed (>10 do-3CFU (colony forming units)). Under favorable conditions, in the presence of other risk factors, more pathogenic microorganisms may be observed, leading to the development of a symptomatic infection. Some authors suggest that vascular operation be used to treat a critically ischemic limb with a primary infection. This assertion seems valid, as in many cases microbiologic examinations confirm the presence of potentially pathogenic microorganisms both on the surface of the operative field and in the inguinal lymph nodes, draining the lymph from tissues affected with infected trophic lesions. However, comparing distant operative treatment results of patients with infected peripheral necrosis to those of “non-infected” patients does not unequivocally confirm that this prognostic factor is of basic importance for predicting the frequency of postoperative infections.

There are various causes of infection. Banadyk and Essen (1) claim that the basic problem is the presence of pathogenic bacterial flora in a patient’s body. The spread of vascular prosthesis infections may involve the migration of pathogenic microorganisms in lymphatic and blood vessels, as well as the presence of inflammatory foci (foci of infected necrosis on limbs, chronic infection of the urinary system, nasopharyngeal carrier state). Szostek et al. (2) maintain that unsatisfactory sanitary practice during the perioperative period is the main cause of infections. He found that in domestic conditions, nearly a quarter of patients undergoing surgical procedures due to artery disease are subject to contamination in the operating room or during dressing changes. Microbiological examinations confirmed such observations: nearly a quarter of patients infected with bacterial strains were characterized by a drug-resistance typical of hospital flora. The growth rates of the bacterial populations observed in our sample were typical of vascular infections. However, attention should be paid to a slightly lower percentage of methicillin-resistant...
strains (MRSA) in our study as compared to many other reports. MRSA strains are isolated worldwide (3, 4) in nearly 70% of similar infections, while in our study, this percentage amounted to 42%. However, comparing these data with research results from 1998 shows that the phenomenon of drug-resistance is more frequent at our hospital (5).

Making a diagnosis is not problematic in most symptomatic infections of vascular prostheses. The reasons for which patients quickly seek medical advice include inflammatory infiltration, presence of purulent fistulas near the operated groin or bleeding from this area. Infections in a closer aortal anastomosis remain a problem. Such a complication is one of the most serious types of vascular prosthesis infection, for which perioperative mortality can be as high as 90% (6). We treated four such patients; unfortunately, three of them died. Apart from the related complications, this weakened state of patients admitted for surgery certainly contributed to the unsatisfactory results of treatment.

Apart from non-specific symptoms, the first signal of such a complication may be bleeding from the alimentary tract, which is often massive, manifesting as a fistula between the prosthesis and the lumen of the alimentary tract (usually a duodenum). Bleeding from the alimentary tract was a primary reason for hospitalization in both patients with this complication who we treated. Notably, endoscopic examination may be useful for a proper diagnosis. In three patients treated, duodenoscopy confirmed the presence of a fistula with a defect in the duodenal wall and a vascular prosthesis, visible in its lumen. Imaging examinations (USG, CT) can also help facilitate a correct diagnosis (7). In one case, ultrasonography confirmed the presence of bubbles of gas in the retroperitoneal space, seizing of the anastomosis area, it is very difficult to make a decision regarding operative treatment. Shilagayi et al. (10) described cases in which, over 6 weeks after transplantation (supposedly sufficient time for a prosthesis to heal correctly), ultrasonographic examination confirmed the presence of a liquid capsule surrounding the prosthesis.

In ologosymptomatic or asymptomatic cases, when control imaging examination suggests the possibility of changes in the prosthesis area, it is very difficult to make a decision regarding operative treatment. Shilagayi et al. (10) described cases in which, over 6 weeks after transplantation (supposedly sufficient time for a prosthesis to heal correctly), ultrasonographic examination confirmed the presence of a liquid capsule surrounding the prosthesis. Such liquid is sterile and its composition is identical to that of plasma, with variable amounts present over long-term observation. Such changes may be due to the relative porosity of the prosthesis, which keeps morphotic elements in the placenta, but passes small amounts of plasma through the wall. These factors may also result from a “host vs. graft” reaction. Such a possibility is confirmed by the fact that a liquid capsule symptom does not remain when a dallon prosthesis is exchanged with a PTFE. Describing a similar case, Cercara suggests that an individual decision should be made in each case, based on additional examinations (CT, USG, HmPAO) of the
clinical state of the patient. Cencora himself elected long-term observation, reserving surgical intervention for symptomatic cases. In our material, we also observed several patients with minimal liquid collection surrounding the prosthesis, which remained for many months without any other accompanying symptoms.

Operative treatment of vascular prosthesis infections is, in cases of evident infection traits, an elective approach to therapeutic management. Attempts at conservative therapy in the event of a diagnosed vascular graft infection are doomed to fail: patients die due to hemorrhage proximal to the anastomosis or symptoms of a generalized infection (6, 11).

The best results were obtained by ablating the infected prosthesis, without trying to reconstruct circulation. Ablation of the infection source resulted in the permanent regression of symptoms in over 70% of patients; however, in our study, this method was burdened with high (nearly 20%) mortality, as well as a significant (40%) percentage of amputations.

To reduce the percentage of amputations, Tolłoczko (12) suggests immediate assessment of the limb’s condition after ablation of the infected graft and, if the blood supply is sufficient, delay of the reconstructive operation. We noted that blood flow through the infected prosthesis was limited by a thrombus or by fibrous hypertrophy in the anastomosis in nearly 50% of patients, whereas the collateral circulation was developed enough to prevent critical symptoms of limb ischemia after ablation of the infected prosthesis. Unfortunately, when patency of the infected prosthesis remained, its ablation is, in most cases, was connected with deep limb ischemia which, in turn, required the restoration of arterial blood inflow. In such circumstances, an operating surgeon is forced to select the most advisable, in his opinion, operative method.

Many authors are willing to perform aggressive operative treatment, with ablation of the entire purulent prosthesis, and to perform an extra-anatomical shunting by-pass. According to these authors, such proceedings allow physicians to eradicate the infection and to save the limb, increasing the chances of survival. Bastounis (13) prefers the axillary-femoral by-pass with ablation of the infected prosthesis en bloc, noting that the decision to perform primary amputation in his study led to a nearly three-times-higher percentage of early deaths in the postoperative period. However, in view of the extensiveness of such operations, the percentage of serious early postoperative complications remains high (14, 15, 16). From our experience, radical operative treatment in patients with the first occurrence of vascular prostheses infection symptoms leads to a high percentage of recurrences and amputations (67%) and should be reserved for cases of repeated infection. Initially, we tried to perform only the least serious operations, if anatomical conditions and the general state of the patient were amenable. Irrigation drainage of the infected prosthesis was performed with the use of high-concentrations antibiotics and antiseptic solutions (e.g., povidine). Unfortunately, a high (85%) percentage of infection recurrences was still observed, despite lengthy periods (6.5 months on average) required for the regression of chronic infection symptoms.

Other authors have also made attempts to save a patent graft (17). Morris et al. (18) applied irrigation drainage in 10 patients with aortic prosthesis infections, resulting in one year’s survival in as many as 80% of cases, without the need for ablation of the prosthesis or limb amputation. It is disputable whether achieving temporary healing of the fistula justifies the risks inherent to such an operation. From our experience, such treatment may be justified for patients with prosthesis infections diagnosed for the first time, in view of the minimal number of patients with primary amputations who underwent this method as well as a mortality rate comparable to that obtained with more radical operations.

Some authors suggest combining irrigation drainage with covering the infected grafts with well-vascularized tissues, i.e., a pedunculated fragment of the omentum or a displaced sartorius muscle (19). In our study (5 such operations were performed), the advantageous results obtained are usually short-lived. After the period of seeming recovery, infection symptoms recurred in 80% of patients, which forced us to undertake more radical measures. We observed an insignificant difference in the percentage of recurrences between application of a vascularized lobe as compared to constant irrigation of the infected area (80% vs. 85%).

In view of a high percentage of infection recurrences after the application of plastic grafts, we sought to perform repeated graft from a patient’s vein (12, 17). For this purpose,
Treatment of vascular prosthesis infections – 15 years of experience

A venous graft from the saphenous or femoral vein is typically used. Apart from obvious advantages, this method also has its disadvantages. The saphenous vein’s diameter allows it to be applied in peripheral grafts, below the inguinal ligament. Obtaining a segment of the vein can be difficult or impossible due to past infections or injuries, varicose lesions or developmental anomalies. Unfortunately, in many cases there is no way to acquire a vein segment of suitable length and diameter. Use of the femoral vein results in difficulties with venous outflow (causing chronic limb edema) in the postoperative period and is connected with operations of increased duration. Moreover, the short length of the acquired vessel limits its application. Nevelsten (29), describing original results he obtained applying surface femoral veins in grafting infections of aortic-iliac segment, highlights the low mortality rate (7%) and relatively scant clinical symptoms of hemostasis in the circulatory system – early edemas were treated with elastic bandages and pneumatic drainage, which caused regression of symptoms during the first 3 months after the surgical procedure in almost all patients.

Intermediate lamella was applied in 4 patients. This method did not prevent the recurrence of infection symptoms, either – the lamella had to be ablated in one case due to a septic hemorrhage from the arteriovenous anastomosis.

In cases with multiple recurrences of infection, we made attempts to apply grafts of preserved human arterial vessels (20, 21). In search of a more infection-resistant material, there have been many attempts to use a human allogenic artery. Complications following insertion of the homograft include a relatively high percentage of early spontaneous rupture of the inserted vessel and separation of the anastomosis. Authors (22, 23, 24) associate the lower resistance of the graft wall with the manner in which allografts are acquired and stored, as well as with difficulties in performing a technically correct, tension-free anastomosis in the presence of inflammation in the operated artery (23). We observed such complications in all cases. We decided to use allogenic grafts stored according to the “cold ischemia” protocol, which are more durable than those prepared using the cryopreservation method of preservation in sub-zero temperatures (24, 25).

More frequent application of this method should allow an objective assessment of its advantages, but the experience we collected so far in applying the allografts is unsatisfactory. Separation of the anastomosis and major bleedings occurred in both cases; the patients were qualified for urgent amputations. One patient died in the early postoperative period.

To reduce the percentage of recurrent infections of grafts sewed in place of the ablated, infected ones, researchers have investigated the use of biomaterials with antibacterial properties. Initially, prostheses were plunged in antibiotic solutions; however, because these were rapidly washed out, this method did not achieve the expected results. Prostheses covered with gel or albumin with antibiotic were proposed to prolong the time required for the extrication of active substance from the prosthesis (31, 32). Others have criticized the clinical usefulness of such prostheses. Naylor et al. (26, 35), applying rifampicin-impregnated prostheses for “in situ” grafts, observed more frequent regression of symptoms, whereas Goeau-Brissoniere et al. (30) present an extensive statistical comparison, which objectively suggests that the above solution is not significantly more efficient than other treatment methods.

It is possible that the progress of biotechnology will facilitate the development of useful tools. Okahara et al. (33) presented attempts to use a prosthesis made of PTFE, with fiber walls containing ofloxacin. Ofloxacin is released at an exactly determined dose and time. Initial in vivo experiments have shown the significant antibacterial activity of such a prosthesis. The other method consists in application of silver-impregnated prostheses, saturated with silver salts, which are known from their antibacterial and bacteriostatic properties. We applied such a prosthesis once; the patient is under observation with no symptoms of infection. One isolated case does not allow us to assess this method conclusively.

Comparing treatment results of the vascular prosthesis’ first infection with treatment results of repeated recurrences, we determined that better results were obtained in the first case (mortality rate of 20% vs 37%), despite application of a less aggressive operative treatment. This confirms Motyka’s and Zaniekiwski’s observations (17) that saving one’s life, limb, death or amputation is conditioned not only
by the kind of vascular reconstruction applied, but also, if not above all, by the extensiveness of the infection, level of intensification of the basic disease and coexisting insufficiencies of other organs.

Regardless of the range of treatment applied and its results, the lot of the patient with infected vascular prosthesis is always unclear. Symptoms of infection may even recur several years after the procedure, despite the period of seeming recovery (9, 10).

Considering the problem of infections in vascular surgery, attention should be paid to the economic aspects of treatment. Long hospitalization periods (74 days on average in our study), as well as the high costs of operations and medications administered, result in a significant underestimation of these procedures in the refund system, whereas treatment of such complications significantly impacts the budgets of hospital departments and vascular surgery teaching hospitals. In our opinion, treatment of vascular prostheses infections should be refunded separately, in accordance with the costs actually borne by the patient.

In view of the lack of satisfactory operative treatment results, a uniform standard of proceedings for patients with diagnosed vascular prosthesis infection is currently lacking. Improved treatment results will require proper prophylaxis. In the future, biotechnology may deliver new materials and treatment methods, which may reduce the percentage of infections, the most harmful complications in the context of vascular surgery (26, 27, 28).

CONCLUSIONS

1. Due to the unsatisfactory results of operative treatment, a uniform standard of proceedings for patients diagnosed with vascular prosthesis infection is currently lacking.

2. Aggressive operative treatment of vascular prosthesis infections is burdened with a high percentage of recurrences and amputations.

3. It seems that less radical operative treatment techniques afford results similar to other, more aggressive methods of treatment.

REFERENCES


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