Background. The left ventricular assist device (LVAD) is used as a bridge to heart transplantation. Currently, these devices are being used for longer periods of time than in previous years for the purpose of bridge to life, thus the need for dental assistance will emerge.

Case description. A female with severe acute congestive heart failure, owing to dilated cardiomyopathy, needed implantation of an LVAD as a bridge to heart transplantation. Six months after insertion of the device she suffered from spontaneous gingival bleeding and sought dental treatment. She presented with several dento-medical problems that required resolution before commencement of dental treatment.


Acute heart failure (AHF) is a clinical syndrome that represents the final pathway of various heart diseases and malformations. Acute cardiovascular emergencies, such as acute coronary syndrome, myocardial infarctions, acute valvular dysfunction, ventricular wall rupture, and pulmonary embolism can precipitate AHF. Regardless of the precipitating event, the pathophysiology of AHF is extremely complex and involves various biological levels from the intracellular level to the organ to organ compensatory interactions. The diagnosis of AHF is made in accordance with the time that has elapsed since emergence of symptoms and signs, the pathophysiology of a failing heart, and the severity of the pathologic course. The onset of signs and symptoms are abrupt, with a dominant element of congestion that is severe enough to require hospitalization and intensive cardiac support treatment. Acute heart failure is evident in 2 forms: acute de novo heart failure and acute decomposition of chronic heart failure, which affects approximately 12% to 50% and 50% to 88% of AHF patients, respectively. This acute syndrome accounts for nearly 1 million admissions to American hospitals each year and harbors the threat of a 20% in-hospital mortality and a yearly mortality rate of more than 40%. For those patients with end-stage heart failure, the sole treatment should be the implantation of an autotrophic heart. Patients with AHF who are eligible for heart transplantation should be treated by all possible modalities until stabilization of their medical condition is achieved. The use of an intra-aortic balloon counter pulsation pump (IABP) and ventricular assist device (VAD) to support cardiovascular stability is mandatory. Whereas IABP is used for short periods, the various types of assist devices are divided into long- and short-term support as a bridge to transplantation, bridge to recovery, and destination therapy.
choice of an assist device depends on the foresight for a heart transplant. Because patients with short-term assist devices do not seek dental treatment, discussion of their condition is beyond the scope of this article. Patients with long-term VADs are more likely to require dental treatment for various obvious dental problems. Two types of assist systems are available: pulsating and nonpulsating. The pulsating pump devices mimic the natural pulsing action of the heart and include the Novacor (Miami, FL, USA) and HeartMate (Thoratec; Pleasanton, CA, USA) XVE pumps. The nonpulsating are the continuous centrifugal or axial flow devices, such as the Incor (Berlin Heart; Berlin, Germany), Jarvik 2000 (New York, NY, USA), and Micromed DeBakey (Houston, TX, USA). A second-generation ventricular assist device is the nonpulsatile type that is built as an axial electromagnetic driven flow pump. The HeartMate II (Thoratec, Pleasanton, CA) is such a device and the first implantation was performed in 2000. After further improvements, a further second implantation was performed at the start of 2004. Since then, this supporting device has been implanted in approximately 600 patients and significantly improved the probability of survival, free of stroke and device failure at 2 years, as well as the quality of life and functional capacity. The dental team treating patients with assist devices is confronted with several possible challenging problems: bleeding tendency, thromboembolic events, imminent infection, device failure, and the problem of checking and assessing vital signs. This article presents a patient with an implanted left ventricular assist device (LVAD) who suffered from spontaneous gingival bleeding. We discuss the possible medical complications that may face the dental team, and suggest a proper mode of treatment.

**CLINICAL PRESENTATION**

At the beginning of 2009, a 40-year-old woman with an indwelling LVAD for acute heart failure was hospitalized in the Cardiothoracic Department because of spontaneous bleeding from the gums and was referred to the Oral Medicine Clinic. The patient was in good health until April 2008 when she suffered from a flu-like illness after which she began to experience severe shortness of breath. Thereafter, she underwent a comprehensive check-up and was diagnosed as suffering from AHF attributable to dilated cardiomyopathy of unknown etiology. Because her heart failure progressed rapidly, the patient was hospitalized in the cardiothoracic department. Within a few days, while still hospitalized, she experienced myocardial infarction with an acute ST segment elevation and a clinical picture of cardiogenic shock. An intra-aortic counter pulsation pump was inserted and her blood pressure was stabilized. Unfortunately, weaning proved unsuccessful. The patient was eligible for heart transplantation and, therefore, the decision for implantation of an LVAD as bridge therapy before implantation was inevitable. The LVAD “HeartMate II” was inserted and her medical condition was stabilized for the following 12 months. Medical history revealed that she suffered from antiphospholipid syndrome. Her medical daily treatment included carvedilol 12.5 mg, furosemide 40 mg, aspirin 325 mg, ramipril 2.5 mg, dipyriramidol 75 mg, warfarin sodium 5 mg, omeprazole 20 mg, and spironolacton 12.5 mg 3 times per week. The patient suffered from recurrent episodes of gingival bleeding despite therapeutic levels of international normalized ratio (INR), which raises the question of possible side effect of the combined antithrombotic treatment. She was referred to the dental clinic to eliminate any possible source of dental bleeding. Differential diagnosis of her bleeding gums included the therapeutic treatment by anticoagulant and antiplatelet medications and periodontal disease. Blood tests showed INR level of 2.3 (normal 1, therapeutic 2.5-3.5). Oral examination revealed gingivitis with red-colored inflamed free gingiva owing to poor oral hygiene. On oral routine examination, bleeding on probing at multiple sites was observed. A pantomographic x-ray was performed. The patient was scheduled for scaling and root planing. The patient received a prophylactic antibiotic dose of 2 g of amoxicillin 1 hour before the treatment and the planned procedures were completed without complications. The bleeding stopped instantly following the periodontal care and did not resume with the adoption of good oral hygiene behavior. The risk of bacterial dissemination while bleeding during everyday activities, such as eating and tooth brushing, was reduced. One month later, patient underwent successful heart transplantation.

**DENTAL IMPLICATIONS AND SIGNIFICANCE**

Dental treatment for a patient with implanted VAD harbors various complex problems. Because the oral medicine literature still lacks evidence-based data on this pioneering treatment modality, the answers to questions regarding proper dental treatment in such a patient should be extrapolated from the knowledge and mode of treatment in similar medical conditions. Other noncardiac surgical procedures were reported in the literature previously. Ten major and 4 minor surgeries were reported in 3 different recent articles. The key for a successful surgical treatment includes the consideration of the following components.

**Bleeding**

Most patients with LVADs need a comprehensive use of antithrombotic treatment. The immediate post-
operative course necessitates administration of heparin that is subsequently substituted by warfarin sodium to achieve the requested INR values. For HeartMate II implant recipients, the use of anticoagulant therapy may be reduced because of antithrombogenic properties of the inner surfaces of the device that promote the formation of a neointimal tissue like material on the surface of the LVAD. The woman presented in this article was known to suffer from hypercoagulability disorder because of antiphospholipid antibody syndrome. Antithrombotic treatment comprised concomitant use of anticoagulant therapy, i.e., warfarin sodium to achieve an INR value of 2.5 to 3.5 (normal value = 1) and antiplatelet medications, such as aspirin and dipyridamol. Before any invasive dental procedure, it is advised to confirm that INR values are within the therapeutic level. Other possible bleeding causes in LVAD-carrying patients are the organ collapse and hepatic dysfunction that are prominent in the preoperative stage of AHF, and the prolonged surgical time of the LVAD implantation, which also contributes to bleeding tendency during the early postoperative course. Our patient sought dental attention because of spontaneous bleeding from the gums. As patients with LVADs have first priority for heart transplantation, only emergency dental treatment should be encouraged. During dental treatment, the dental team should be aware of possible postdental bleeding. The INR ratio should be carefully monitored. Most patients with LVADs require INR levels of 2 to 3. Such levels of anticoagulant therapy do not require the switch to heparin or the discontinuation of anticoagulant therapy or antiplatelet medication. However, invasive treatments, such as scaling and root planing should be performed with caution, beginning with the lower anterior teeth while assessing excessive bleeding. Our patient underwent scaling and root planing without any bleeding problems. We would like to emphasize that despite the combined antithrombotic treatment, the most frequent cause of bleeding from the gums is periodontal disease, which may be aggravated by the treatment. Therefore, even a minute dental procedure is of utmost importance for the prevention of bleeding.

**Thromboembolic events**

The threat of a thromboembolic event ranges from as low as 2% up to 50% depending on the sort of device and the definition of emboli. To prevent stasis and possible thrombi formation, frequent leg movements, such as flexion and extension of the foot should be encouraged while seated in the dental chair. The treating team should be aware of any change in the patient’s awareness and possible neurological deficits, such as alteration of consciousness, neurological deficits, sensory disturbances, and dysarthria.

**Imminent infections**

Infection of assist devices may originate in the pocket, the drive line, and bloodstream and cause prosthetic device endocarditis. The major threat of infection from dental origin is from the dissemination of microbial inoculums following dental treatment that involves the disruption of the gingival integrity. In patients who suffer from gingivitis with gingival bleeding, this risk of bacterial dissemination appears also in daily activities, such as eating and tooth brushing. This in turn may expose the intravascular apparatus to infective artificial device endocarditis. The LVAD implantation causes activation of T cells and progressive apoptosis and eventually depletion of cellular immunity cells, which reduces immunity to infections.

There is no evidence-based research that shows the benefits of antibiotic prophylaxis for the prevention of infective endocarditis. The current suggestion of antibiotic prophylaxis for a cardiovascular implantable electronic device is not relevant in these patients because the recommendations are directed to implantable pacemakers and defibrillators. LVAD is a new medical device that has more of a resemblance to artificial heart valves, which are high-risk devices, than to the pacemakers and implantable defibrillators. Thus, the high frequency of infections, as well as the LVAD’s similarity to an extended heart valve, the hazardous consequences of infection, and major surgical action that should be taken in the event of infection all lead us to think that antibiotic prophylaxis can be beneficial for these patients. The protocol of prophylactic treatment should be in accordance with the high-risk group in the latest American Heart Association/American College of Cardiology/American Diabetes Association (AHA/ACC/ADA) guidelines.

**Device failure**

The main concern in the long-term normal action of the LVAD is directed toward the perfect undisturbed function of the device. Therefore, the new generations of nonpulsatile long-term support comprise a single movable part. The HeartMate II is an electromagnetically derived movable axial flow rotary device. Despite no existing evidence that the use of magnetic dental instruments may interfere with the normal function of the pump (Thoratec company information), on the basis of cost-effectiveness one should be advised to refrain from using ultrasonic scalers and ultrasonic cleaning baths until more information is evident.
Sitting position

Because the patient should always wear an external battery pack jacket, all attempts should be made to arrange the best possible sitting position. A second emergency pack should be within hand reach of the patient.

Assessment of vital signs

Heart-Mate II is a nonpulsatile device and, therefore, the blood pressure does not fluctuate and Korotkoff signs are not evident. Thus, there is no practical way to measure blood pressure and heart rate. This raises the question of how vital signs should be evaluated in the dental clinic apart from the awareness to altered consciousness. The only way in which health care workers can manage cardiovascular stability is by assurance of proper function of the LVAD and evaluation of the patient’s behavior.

REFERENCES