New Treatment for Infection of the NIPRO LVAD Cannula Site: Nihon University Crystal Violet Method

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Driveline and cannula site infections are still a frequent adverse event in patients with a ventricular assist device (VAD), and it is important to treat and prevent them because the spread of local infection may cause sepsis in some cases. We report our experience with a patient in whom infection of the NIPRO LVAD cannula site after implantation of an extracorporeal VAD was controlled by treatment with crystal violet Solbase (Nihon University crystal violet method).


Along with thromboembolism and bleeding, infection can be a serious adverse event after implantation of a ventricular assist device (VAD) [1]. Although the incidence of infection has tended to decrease after development of the smaller continuous-flow VAD compared with the pulsatile-flow LVAD, infection is still a frequent adverse event in patients who require long-term assistance such as destination therapy [2, 3]. However, the methods for prevention and treatment of cannula site and driveline infections have not yet been established. We report our experience with a patient who had infection of the inflow and outflow cannulas of the NIPRO LVAD caused by methicillin-resistant Staphylococcus aureus (MRSA). This infection responded to treatment of the wound with crystal violet Solbase.

A 43-year-old man visited our Department of Cardiology with dyspnea. Congestive heart failure was diagnosed. The ejection fraction (EF) determined by echocardiography was only 16.9%. Because of his frequent ventricular arrhythmias, we performed CRT-D implantation. The patient went into cardiogenic shock and required an intraaortic balloon pump. On day 28 of hospitalization, we performed implantation of an extracorporeal LVAD. The patient’s hemodynamics were stabilized after the operation.

Postoperatively, the patient received prophylactic antibiotic therapy with piperacillin and cefazolin for 8 days, and the cannula site was disinfected with ethanol. From postoperative day 9, the area surrounding the cannula site became red along with purulent discharge, and MRSA was detected by culture (Fig 1). The wound was treated by disinfection with ethanol after cleansing with saline and application of crystal violet Solbase around the cannula site. Crystal violet Solbase is an ointment prepared by mixing 0.01% methylrosanilinium chloride and Solbase (macrogol 400:50 g and macrogol 4000:50 g). Macrogol 400 is a viscous liquid that is used as a base for ointments and suppositories, and macrogol 4000 is a small piece of paraffinoid substance that is used as an ointment base. Bacteria were not detected at the cannula site by weekly culture tests, and the redness around the wound improved (Fig 1). Systemic antibiotics were not used after the infection around the cannula site was controlled macroscopically. On postoperative day 147, the patient experienced a cerebral infarction, but his symptoms subsequently improved. However, he experienced a cerebral hemorrhage on postoperative day 173, and death was confirmed on the same day. At the time of death, there were no macroscopic findings suggestive of infection as a result of examination of the area around the cannulation site.

Comment
Methylrosanilinium chloride (crystal violet or pioktanin), which was used for the cannula site infection in the present patient, was synthesized in the 1860s as a triphenylmethane pigment. It is well known as a blue pigment for gram staining and is also used as an antimicrobial and antiparasitic agent [4]. Methylrosanilinium chloride shows activity against gram-positive bacteria and Pseudomonas aeruginosa. Because of its potent

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bactericidal activity against MRSA, which is 500 times higher than that of povidone iodine, it is used for the treatment of postoperative subcutaneous abscesses and decubitus ulcers, and its efficacy has been rediscovered recently [4, 5]. The optimum method of disinfection to prevent driveline infection or cannula site infection has not been established. Although we are unaware of published reports of this application, liquid methylrosanilinium chloride is used at some institutions in Japan, but data on its efficacy are lacking.

When methylrosanilinium chloride is used as a liquid, the strong color makes it difficult to observe the response to treatment. Therefore, we added Solbase to methylrosanilinium chloride to prepare an ointment (Fig 2).
Solbase is a water-soluble ointment that is poorly absorbed percutaneously itself but that promotes the percutaneous absorption of drugs combined with it as an ointment base. It is effective for accelerating the healing of skin wounds and preventing bacterial invasion by protecting the skin and mucosa, absorbing secretions, accelerating surface drying, and promoting granulation. Water-soluble Solbase can be washed off the wound site and thus does not obstruct the observation of wound healing. We used crystal violet Solbase to treat cannula site and driveline infection caused by MRSA in the present patient. We have also used this ointment for disinfection immediately after implantation to prevent driveline infection in 6 patients with an extracorporeal LVAD (duration, 4 to 240 days) and 1 patient with the HeartMate II implantable LVAD, with the result that none of these patients experienced infection (Fig 2). However, the number of patients who have received this method of disinfection is still small, and patients who received extracorporeal LVAD died of adverse events other than infection. We also used this method of disinfection immediately after implantation in the HeartMate II patient, who currently has not experienced any adverse events such as driveline infection 9 months after implantation. The procedures for using crystal violet Solbase for disinfection are as follows: (1) Remove any matter attached to the cannula or driveline. (2) Disinfect an area approximately 5 cm² centering on the cannula site, using ethanol three times (particularly the posterior region of the cannula or driveline). (3) Apply crystal violet Solbase to cover the cannula or driveline using a clean spatula. (4) In the case of LVAD, place a 2-cm square thin gauze over the crystal violet Solbase on the cannula, and cover it with a 10-cm square thin gauze. In the case of HeartMate II, place a 2-cm square thin gauze over the crystal violet Solbase on the driveline, and fix it with a dressing agent (SorbaView SHIELD, Centurion Medical Products, MI). We continued to conduct this disinfection once daily even when patients had no signs of infection. A report from the University of Pittsburgh states that driveline infection was improved by the application of honey; the high sugar content of honey reduces intracellular water and inhibits bacterial growth, and the gluconic acid in honey has a direct antimicrobial effect [6]. It has also been reported that allogeneic platelet gel [7] and platelet-rich plasma [8] were effective for driveline infections. The patient's own blood is centrifuged to obtain a platelet concentrate, and the growth factors contained in platelets accelerate tissue regeneration and repair. Although this method could be promising, it has not been studied in many patients, and only a case report has been published.

Crystal violet Solbase is also expected to be useful because methylrosanilinium chloride is effective against MRSA. It is also cheap, causes few adverse effects such as cutaneous reactions, and as an ointment protects the skin, absorbs secretions, and prevents bacterial invasion. We hope to demonstrate the efficacy of this method in a larger number of patients in the future.