Wireless magnetic actuators and applications

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Typically, the mechanical blood pumps consist of an electrical motor, shaft, bearing, and impeller, and they require a power cable or TETS with an implantable battery. The general configuration of a blood pump can cause several problems, including heating, abrasion, and bacterial infections. A magnetically levitated motor for a blood pump was recently developed to achieve a smaller pump size, and to prevent heating and abrasion from the mechanical components, such as the shaft and bearings. However, the driving power was transmitted by a percutaneous power cable. Therefore, the TETS method has been developed to solve problems associated with a percutaneous the power cable, such as bacterial infections. The use of a TETS, which requires an implantable battery with a control circuit, is one of the methods used for wireless power transmission. However, when the TETS is used for an implantable blood pump, the complex configuration requires a difficult surgical operation. Thus, a new method is required to avoid these problems. In this study, I proposed new strategies for a functional blood pump based on wireless control. The newly developed pump has the simplest pump structure: it has a pump housing and a fully magnetic impeller, without a shaft and mechanical bearings. I previously designed blades in the magnet. Therefore, an external rotating magnetic field or the rotation of an external magnet drives the pump without the use of a power cable or implanted battery. In addition, a simple power generator to drive the electronic devices without an additional power source was achieved using a wound coil in the pump case. The pump has a total volume of 20 cc and weighs 52 g. In addition, the pump produces a maximum flow rate of 8 L/min at 80 mmHg as a centrifugal pump. Because of its small size, the pump is suitable for use as a pediatric pump.