Pumps in Pharmacotherapy

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Definition

During the last few years a new method of medication has experienced wide-spread use, for which so far no generic term has been established. Its outstanding characteristic is the application of drug solutions with the use of technical aids, especially pump systems. This method has raised hopes that certain problems of pharmacotherapy, which until now seemed to be unsolvable, may be overcome in the near future. Definitions of this pharmacological regimen as well as the technical devices necessary to realize it are given in Table 1.

Pump systems allow parenteral, percutaneous and local longterm infusion of different substances in ambulatory patients. There are two possibilities for pump medication: either the complete system (pump, reservoir, catheter) is totally implanted and has to be refilled percutaneously at regular intervals; or parts of the system, i.e. pump and reservoir, are carried outside of the body (external portable pumps) and may be refilled directly. With the latter method the connection to the place of drug administration is maintained by an implanted catheter and port.

Lower costs are the main advantage of partly implanted systems because external pumps are less expensive than implanted ones and may be reused in different patients. At the same time, the use of portable pumps requires some cooperation of the patients if continuous drug infusion is to be done not only during clinical treatment but also in ambulatory care. Under these conditions the patients themselves have to make use of their pump without medical assistance, even if they have no influence on the dosage delivered during a definite period of time. As the mode of application, especially the dosage, may be preset by the clinicians in charge of these patients, the risks of home care without medical supervision, i.e. inadvertent or advertant overdosage, may be reduced. Of course, port-catheter systems may be used as well for on-demand techniques of infusion (allowing the patients to decide on his dosage) or for simple injections, i.e. for bolus-application.

Totally implantable systems, in which pump, reservoir and catheter are completely within the body, function independently from the patient and do not require additional measures on the part of the patient. In addition, the system is “out of reach” of the ambulatory patient. Implantable systems are more expensive, cannot be reused after explantation and their implantation is associated with a surgical procedure, similar to the insertion of a cardiac pacemaker.

The use of a totally implantable pump system should be restricted to long-term or life-long therapy. Medication with pumps for a limited period of time (reversible symptoms and diseases, short life-expectancy) usually can be sufficiently done with a port-catheter system and an external pump. If the efficacy of local drug therapy is not predictable or if a period of dose-finding is necessary prior to definite infusion, a port may be used first and then replaced with the implantable pump. In all patients the advantages and disadvantages, as well as the costs of one or the other pump system and its comparison to conventional therapy, must be evaluated in advance.
Table 1. Definition I–IV

Definition I

Percutaneous/local, mostly continuous long-term infusion of different drugs in ambulant patients with the use of catheters, pumps or ports.

Definition II

1. Totally implanted system
2. Partly implanted system
   – implanted: catheter + port
   – external: pump + reservoir

Definition III

Port = subcutaneous injection – or infusion – chamber for percutaneous access

1. dome-shaped port
2. solid-rim port

Definition IV

Connection external pump-port:

- needle
- catheter

The critical point of a partly implantable system is the transcutaneous connection between the external and implanted parts of the system. The device that serves this purpose is the so-called port, a small subcutaneous injection- or infusion-chamber of about the size of a coin. On one hand, it represents the beginning of the implanted catheter; on the other hand, it allows access for the external parts of the system. Its rub-