Ann R Coll Surg Engl 1997; 79: 257–258

Infusion pumps for systemic and intra-arterial chemotherapy of colorectal liver metastases

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Key words: Chemotherapy; Cost savings; Infusion pumps; Infusions, intra-arterial; Infusions, intravenous

Over a 12 month period, we prospectively evaluated the use of an ambulatory infusion pump for intra-arterial and intravenous chemotherapy in patients with colorectal liver metastases. In all, 274 separate infusions were given with minor complications occurring on six occasions. Administering treatment on an outpatient basis rather than as an inpatient has resulted in savings of over £17 000 in the first year.

Most patients with colorectal cancer will develop metastatic or recurrent disease. For most of these, chemotherapy remains the most suitable treatment as only a small percentage will benefit from further surgery.

Both the de Grammont regimen, which is based on a 48 h 5-fluorouracil (5-FU) infusion modulated by a preceding high dose folinic acid infusion *(1)*; and continuous 5-FU infusions *(2)* are widely used within the UK. Recent studies have suggested that intra-arterial chemotherapy may be of benefit in prolonging survival and maintaining quality of life *(3,4)*. In some units these forms of treatment require the patient to be hospitalised. Cost savings could be made if these treatments could be delivered on an outpatient basis using external ambulatory infusion pumps.

We therefore evaluated the morbidity and potential cost difference in treating patients with metastatic colorectal cancer confined to the liver, with both regional and systemic 5-FU, with an ambulatory infusion pump compared with inpatient treatment. The period of study was 1 year.

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Methods

A total of 16 patients with an age range of 33–73 years, including eight women, received treatment over the course of 1 year using the Baxter infusion pump (Baxter Healthcare, Reading, UK) (Fig. 1). This portable peristaltic pump weighs 365 g and measures 12.5×9×4.5 cm, small enough to be worn on a waist-band. It is powered by a 9 V battery and can be fitted with disposable drug reservoirs of up to 250 ml. Infusion rates can be varied from 0.1 to 19.9 ml/h. Before starting treatment, each patient was given basic training in stopping and starting the pump and changing batteries. If the patients had pain at the peripheral cannula or port site they were asked to contact the hospital for advice. Simple 'first aid' instruction in case of cannula and port problems at home was also given.

Intravenous infusions were given using 22G peripheral cannulas (Biovalve, Vygon, France). An infusion of 200 mg/m^2 folinic acid was given over 2 h, followed by a bolus of 400 mg/m^2 5-FU, followed by an infusion of 600 mg/m^2 5-FU over 22 h. This was repeated on day 2 and the 2-day regimen repeated every 2 weeks. The intra-arterial chemotherapy was given through a surgically implanted catheter and subcutaneous injection port (Jet Port Plus, PFM, Cologne, Germany). An intravenous

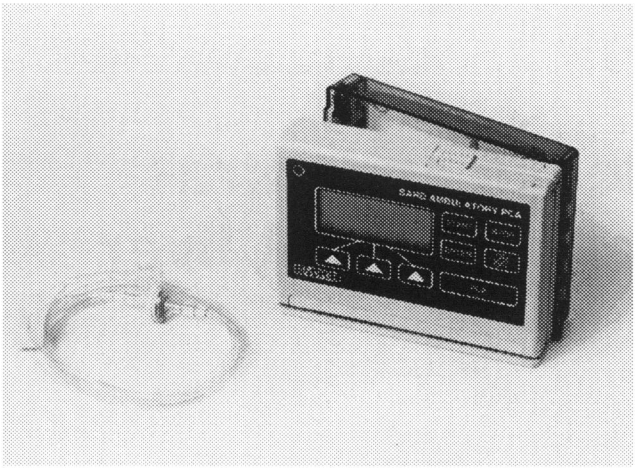

Figure 1. Baxter infusion pump with administration set.

infusion of 200 mg/m^2 folinic acid was given over 2 h followed by an intra-arterial bolus of 400 mg/m^2 5-FU, followed by an intra-arterial infusion of 1600 mg/m^2 of 5-FU over 22 h. This was repeated on day 2 and the 2-day regimen repeated every 2 weeks. A 2-week break was given after every 12 weeks of intravenous or intra-arterial treatment.

Patients returned to the hospital on each morning of treatment to have chemotherapy reservoirs changed, ports disconnected or cannulas removed. Peripheral cannulas were fixed down with a clear adhesive dressing (Tegaderm®, 3M, Canada) and further secured with a crêpe bandage. Cannula sites were inspected on each morning of treatment for signs of infection or extravasation. Needles used to pierce the subcutaneous ports (Porta-Cath® needle, SIMS Delta Inc, St Paul, USA) were held in position with gauze swabs and clear adhesive dressings.

Results

A total of 274 separate infusions was given using this pump, 130 of these being intravenous cycles.

On three occasions patients suffered from bleeding from the skin where the needle pierces the intra-arterial infusion port. A small haematoma was aspirated from one of these and the remainder controlled by removing the needle, obtaining haemostasis with light pressure and resiting the needle in a different position. On no occasion did arterial bleeding occur back down the cannula into the drug reservoir.

Intravenous cannulas occluded on three occasions requiring the patient to return to hospital to have it resited. No extravasation of drug occurred and no cannula site became infected. With the cannula fixed with adhesive dressing and a bandage none became disloged.

Discussion

This pump had been reliable and safe in delivering intra-arterial and intravenous infusions on an outpatient basis. All patients had remained mobile while receiving treatment and carrying the pump rarely interfered with daily activities. Seven of these patients were able to continue work while using the pump. Using peripherally placed cannulas for intermittent infusional chemotherapy also appears to be safe when used in outpatient treatment.

In our hospital the cost of an acute surgical bed is £95 for 24 h. The use of disposables (dressings etc) would be identical for inpatient and outpatient treatment. We have used five pumps, allowing 20 patients to receive treatment according to these regimens. Over the first year the savings on performing this treatment on an outpatient basis have been £17 030 (274×190−1800×5). Obviously, over time more savings would be recouped as the pumps are expected to last for a number of years.

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Received 14 October 1996