Home intravenous self-injection of antibiotic therapy

AY MARTEL. Home intravenous self-injection of antibiotic therapy. Can J Infect Dis 1994;5(Suppl C):51C-55C. The current medical climate has forced all health care providers to search for alternative methods for the delivery of health care. This search has led to the use of sites outside the conventional hospital walls for peritoneal dialysis, parenteral hyperalimentation, blood or blood product transfusions, etc. Home intravenous self-injection of antibiotics is such an alternative to prolonged and/or repeated hospitalization for patients requiring intravenous antibiotics administration only. This alternative was started as a pilot study and soon became a usual service in the Centre hospitalier de l'Université Laval following receipt of a grant from the National Health Research and Development Program. After careful development of inclusion/exclusion criteria and a teaching manual for patient and health care providers, and the standardization of medical, pharmaceutical and nursing approach, a clinical, psychosocial and economical analysis of patients who agreed to participate in a clinical study comparing the two methods of health care delivery (hospital versus home) was started. Patients who met inclusion/exclusion criteria, agreeing to finish their treatment at home instead of staying hospitalized to receive intravenous antibiotics only, were taught the various techniques of intravenous self-injection. Once they were judged to be able to self-administer the antibiotics, they were sent home with the material needed to carry on their treatment.

To date, more than 100 patients have participated in the home-treatment, of which 50 were analyzed. The duration of home treatment varied from two days to several months. Most patients had osteomyelitis, septic arthritis, septic bursitis, bacterial cellulitis or lung infections. The therapy allowed some newly defined patients with complicated infections (AIDS patients with cytomegalovirus retinitis) to continue their treatment at home. The clinical outcome of patients treated at home was identical to the outcomes of those treated in the hospital. Side effects were comparable with the hospital treatment and were mainly catheter-related. Compared with hospitalization, home treatment was preferred by the majority of patients. Psychological analysis of the patients showed that those who choose home therapy had a higher internal 'locus of control' than those who preferred to stay in the hospital for the entire length of therapy. The economical analysis showed a potential reduction of cost varying between $894.00 and $3325.00 per treatment. Home intravenous self-injection of antibiotics allowed health self-monitoring by the patients or/and their friends or family and increased health care efficiency.

Key Words: Antibiotic therapy. Home intravenous self-injection

Antibiothérapie intraveineuse à domicile

RÉSUMÉ : Les restrictions budgétaires actuellement ressenties dans le domaine de la santé ont forcé tous les intervenants à chercher des alternatives à la dispensation actuelle des soins. Cette recherche a conduit à l'utilisation de lieux de traitement situés hors des murs hospitaliers actuels pour la dialyse péritonéale, l'hyperalimentation parentérale, les transfusions de sang et de dérivés du sang, etc. L'autoadministration d'antibiotiques par voie intraveineuse à domicile est une alternative à l'hospitalisation prolongée et/ou

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repeatedly beneficiaries who do not require an administration of antibiotics by the veins. This alternative to hospitalization has been used by a project pilot and is inserted, by the result, in a context of dispensation normal of the diaries in the Centre hospitalier de l'Université Laval at the moment of the obtention of a subvention of the Programme National de Recherche et de Développement en Sante. After the elaboration of criteria of inclusion, the development of a manual of teaching to the beneficiaries and to the intervenants and the uniformisation of the approach of the doctors, of the pharmacists and of the infirmiers, we have been doing a study of antibiotic, psychosocial, and economic of the subjects who participate at the treatment at domicile in the comparing to a clientil who prefers to pursue their treatment at the hospital. Les sujets qui répondent aux critères d'inclusion et qui demeuraient hospitalisés pour recevoir une antibiotherapie intraveineuse, étaient instruits des techniques d'administration intraveineuse. Après avoir démontré leur capacité à s'auto-injecter les antibiotiques, ils étaient liberes de l'hôpital avec le matériel necessaire à poursuivre leur traitement. Jusqu'à maintenant, plus d'une centaine de sujets ont participé au traitement. La durée du traitement à domicile des sujets a varié entre deux jours et plusieurs mois. La plupart des sujets présentaient une ostéomyélite, une arthrite septique, une bursite septique, une cellulite bactérienne ou une surinfection bronchique. Cette alternative a aussi permis à certains sujets atteints d'autres infections compliquées, ex: sideens avec rétinite à Cytomegalovirus, de poursuivre leur traitement à domicile. L'évolution clinique des sujets à domicile comparée aux sujets hospitalisés était comparable. Les effets secondaires n'étaient plus fréquents qu'à l'hôpital et le traitement à domicile était préféré au traitement hospitalier dans la majorité des cas. L'analyse psychologique des sujets a démontré qu'ils avaient un "docus de contrô'se interne plus significativement élevé que ceux qui préféraient demeurer hospitalisés. L'analyse économique a démontré une économie potentielle pouvant varier entre $941.00 and $3325.00 by treatment. L'autogestion intraveineuse d'antibiotique à domicile permet l'autogestion de la santé par le bénéficiaire et/ou son entourage et augmente l'efficacité du système actuel de soins.

The national health care system is taking new directions: patient self-sufficiency and costs are now considered with quality of care. Patients with chronic illnesses often require prolonged or repeated hospitalizations. To shorten hospital stay, programs such as home hemodialysis (1-3) and peritoneal dialysis (4-6), parenteral hyperalimentation (7-9) and home transfusions (10,11) are already offered to patients. These programs are considered to be hospital alternatives and their implementation is strongly encouraged. They are felt to increase health care system access by freeing up hospital beds. They contribute directly to clear up emergency room beds by treating patients at home when their illness is stabilized.

Home intravenous self-injection of antibiotics is part of this innovative perspective (12-20). It helps patients to be self-sufficient in their own care. Advantages for the patient are numerous. Home intravenous self-injection of antibiotics helps the patient to carry on treatment at home after a shorter hospital stay; it allows a more rapidly recovered autonomy; it improves quality of life by allowing more rapid resumption of familial and social life; and finally, it lowers hospital-related emotional and physical burden.

This paper summarizes the results of a pilot study and a prospective study done at Le Centre Hospitalier de l'Université Laval between 1984 and 1991 (21,22).

**Patients and Methods**

From January 1984 to May 1989, home intravenous self-injection of antibiotics was a case by case service offered to patients who wanted to go home while in hospital for intravenous antibiotics (23). To implement the service, all parties involved were identified. An infectious diseases consultant, a pharmacist, a department nurse, an out-patient nurse and an administrator formed a committee whose task was to define admission criteria, develop procedures to be followed by the patient and other parties, and standardize teaching procedures to patients as well as the ways to prepare and deliver antibiotics.

Admission criteria were: age (range 18 to 65 years); treatment of the infection with intravenous antibiotics only (no oral alternatives, no other treatments while on intravenous antibiotics); clinical stability, with lack of
of the two alternatives were compared (Figure 1). The patients' training program lasted from three to five days and was presented by the doctors. Nurses and pharmacists tried to standardize participant interventions, to familiarize patients with infusion material, antibiotics, solutions, to demonstrate methods to the patients' families and to check for the appropriate execution of the techniques by the patient after proper evaluation of patients' skills. Nurses and pharmacists were also referred to as a backup for patients at home as in- or out-of-hospital contacts.

RESULTS

More than 116 patients participated in the treatment at home. Of these, 33 were evaluated prospectively and compared with 17 patients who preferred to carry on their treatment in the hospital. There were 28 females and 88 males. Mean age was 41 years in females (range 16 to 60) and 36 years in males (range 16 to 62). Almost half had osteomyelitis; pathologies are outlined in Table 1.

The pathogens most frequently isolated reflected those most often involved in such infectious diseases (Table 2). Gram-positive cocci, mainly Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus warneri, Group A beta-hemolytic streptococcus, Group B beta-hemolytic streptococcus, Streptococcus viridans

Gram-positive bacilli: Bacillus species

Gram-negative cocci: Neisseria species

Gram-negative bacilli: Pseudomonas aeruginosa, Xanthomonas maltophilia, Serratia marcescens, Escherichia coli

Anaerobes: Fusobacterium species, Bacteroides fragilis, Streptococcus anaerobius

Mycobacterium avium intracellulare

Parasites: Toxoplasma gondii

Yeasts: Blastomyces dermatitidis, Cryptococcus neoformans

Virus: Cytomegalovirus

complication due to infection or treatment; and easy intravenous access.

At the beginning, the program was introduced to patients who wanted to go home. Later, patients who preferred to stay hospitalized were also included in the prospective analysis. The analysis included clinical outcome and sociopsychological and economical aspects of the two alternatives. From the time the patient's condition was judged stable until one month post-treatment, patients were followed by the main investigator through weekly clinical exams completed with once-weekly blood samples for various biological determinants to assess clinical evolution. Safety and efficacy of the two alternatives were compared (Figure 1).

Sociopsychological evaluation proceeded through the administration of questionnaires to determine the patient's phobia avoidance, health locus of control (24), opinions on illness and antibiotic therapy and the presence of psychopathological disorders that would compromise the course of the program (major depression, severe anxiety, intravenous drug abuse). Questionnaires included the Beck depression inventory (25) and the Spielberger anxiety scale (26), which were followed by a diagnostic interview with a psychologist. All were performed at different times throughout the course of antibiotic treatment (Figure 1).

The economical analysis proceeded through identification of resources used during treatment, identification of their unit cost by stepdown costing (27) (better than per diem) and the calculation of the real cost of treatment (Figure 1).

The patient's training program lasted from three to five days and was presented by the doctors. Nurses and pharmacists tried to standardize participant interven-

TABLE 1
Pathologies treated with home intravenous antibiotics

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Patients treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteomyelitis</td>
<td>56</td>
</tr>
<tr>
<td>Septic arthritis</td>
<td>12</td>
</tr>
<tr>
<td>Septic bursitis</td>
<td>7</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>8</td>
</tr>
<tr>
<td>Cystic fibrosis with bronchial surinfection</td>
<td>9</td>
</tr>
<tr>
<td>AIDS patients</td>
<td></td>
</tr>
<tr>
<td>Cytopemgalovirus retinitis</td>
<td>5</td>
</tr>
<tr>
<td>Cryptococcosis</td>
<td>2</td>
</tr>
<tr>
<td>Disseminated Mycobacterium avium</td>
<td>1</td>
</tr>
<tr>
<td>complex infection</td>
<td></td>
</tr>
<tr>
<td>Cerebral toxoplasmosis</td>
<td>2</td>
</tr>
<tr>
<td>Syphilis</td>
<td>1</td>
</tr>
<tr>
<td>Complicated urinary tract infection</td>
<td>2</td>
</tr>
<tr>
<td>Severe external otitis</td>
<td>3</td>
</tr>
<tr>
<td>Chronic sinusitis</td>
<td>3</td>
</tr>
<tr>
<td>Cutaneous blastomycosis</td>
<td>1</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>2</td>
</tr>
<tr>
<td>Lung abscess</td>
<td>1</td>
</tr>
<tr>
<td>Liver abscess</td>
<td>1</td>
</tr>
</tbody>
</table>
for patients treated in the hospital. The differences between the alternatives were accounted for by nursing time, professional fees and hostelry. All scored significantly higher in the hospital group.

**DISCUSSION**

Intravenous antibiotic therapy can be delivered to out-patients in several ways. Self-injection is probably the most efficient way to deliver intravenous antibiotics, as long as there is a careful selection of patients who participate in such treatment and adequate nursing support. Patients who prefer to be treated at home had a statistically higher internal locus of control than patients who stayed in hospital. They preferred home treatment because this alternative gave them the opportunity to keep a higher quality of life, a normal familial life and a greater autonomy. They could carry on normal activities while under treatment. Those who decided to stay in hospital had a higher external locus of control, less confidence in their own efficacy to deal with their health problem and did not see advantages to carrying on their treatment at home. The majority of patients treated at home preferred this option to hospital and would do it again in a proportion of 89%. If the patients had to pay for the cost of the antibiotics, this preference would be lowered to 32.4%. Other major pitfalls related to home treatment were related to transportation to the out-patient clinic for follow-up visits and the infusion schedule.

In agreement with previous studies, we found no statistical difference in the clinical outcomes between patients treated at home and those treated in hospital. Some pathologies seemed to best fit such a program due to the length of treatment, ie, osteomyelitis, cytomegalovirus retinitis, and/or the recurrence of the infections (bronchial superinfections in cystic fibrosis patients). The choice of antibiotics must be guided by several pharmacokinetic characteristics. Antimicrobial spectrum, tissue penetration, half-life at room temperature once diluted as well as half-life once infused, and compatibility with other antibiotics in the same infusion bag are the most important points to consider. Anatomical sites for intravenous line insertion and peripheral versus central lines must also be identified before the patient is sent home.

We observed a trend towards lower costs for home treatment versus hospital treatment although there was large overlap between the two alternatives. The cost in personnel and lodging accounted for about 80% of the cost in hospital. Are these savings going to decrease the cost of health care? This question remains partly unanswered since the health care budget is scrutinized by different sectors. Compared with the cost of the actual treatment of hospitalized patients, home self-injection of antibiotic treatment is economical. But, from an administrative viewpoint, offering the home therapy alternative is not economical because the beds are freed for more
urgent or sicker patients, whose care will be more expensive than the antibiotic therapy. Furthermore, if the hospital has to pay for the cost of antibiotics, the cost to the hospital administration will be higher because the bed will be occupied by another patient and, at the same time, the hospital will have to pay for the intravenous antibiotic therapy for the patient discharged home.

In the context of closed budget and reduced expenses, it seems to be very difficult for Canadian health care advisers to make the right decisions without threatening some of the basic principles of free quality health care that has guided this society. Making available alternatives such as this one for out-patient treatment is one answer to the increasing concern with health care costs. People are more aware of their capacity for self-treatment as long as we provide them with an adequate supervision to make them confident of their own capacities. This kind of treatment is likely the beginning of several other alternatives for out-patient treatment.

REFERENCES