

Outpatient intravenous antibiotic therapy: The Vancouver Hospital experience

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H Grant Stiver, A Wai, L Chase, L Frighetto, C Marra, P Jewesson. Outpatient intravenous antibiotic therapy: The Vancouver Hospital experience. *Can J Infect Dis* 2000;11(Suppl A):11A-14A.

From June 1, 1995 to December 31, 1997, 334 patients at the Vancouver Hospital and Health Sciences Centre (VHSC) were referred to and screened for, outpatient intravenous antibiotic therapy. One hundred and ninety were accepted, 107 of whom were cared for under the VHSC program and 83 of whom were discharged to continue intravenous therapy in their own health region. Thirty-four of 144 patients not accepted for outpatient intravenous therapy, were screened by the Infectious Disease Service and Pharmacy, and were discharged on oral antibiotics. Peripherally inserted central catheters were employed in 61 of 107 (57%) patients, peripheral short catheters in 20 (19%), Hickman lines in 14 (13%), and Port-a-caths in 12 (12%). Ninety-two of 107 patients treated in the VHSC program completed their course uneventfully with resolution of the infection. The average duration of hospital therapy was 10.9 days versus 23.6 days of outpatient therapy. In 15 patients, home treatment was discontinued because of clinical deterioration: adverse drug reaction (n=2), phlebitis (n=2), unsuitable home environment (n=1), noncompliance (n=1), line-related sepsis (n=1) and death due to unrelated causes (n=1). There were 15 adverse drug reactions overall in the total of 2534 patient-days of therapy over 18 months. Cost analysis showed a cost of 12 cents on the dollar compared with in-hospital therapy.

Key Words: *Bacterial infection; Health care programs; Outpatient parenteral antibiotics*

Antibiothérapie intraveineuse sans hospitalisation : Expérience du Vancouver Hospital

RÉSUMÉ : Du 1^{er} juin 1995 au 31 décembre 1997, 334 patients du *Vancouver Hospital and Health Sciences Centre* (VHSC) ont été adressés et sélectionnés pour une antibiothérapie intraveineuse en externe. Cent quatre-vingt-dix patients ont été acceptés; 107 ont été pris en charge par le programme du VHSC et 83 ont obtenu leur congé afin de recevoir leur antibiothérapie intraveineuse sous la supervision de l'unité sanitaire de leur localité. Trente-quatre des 144 patients qui n'avaient pas été acceptés pour l'antibiothérapie intraveineuse en externe ont été sélectionnés par le service des maladies infectieuses et de la pharmacie et ont reçu leur congé avec des antibiotiques oraux. On a eu recours à des cathéters centraux périphériques chez 61 patients sur 107 (57%), à des cathéters périphériques courts chez 20 patients (19%), à des lignes Hickman chez 14 patients (13%) et à des Port-a-cath chez 12 patients (12%). Quarante-deux patients sur les 107 traités dans le cadre du programme du VHSC ont reçu leur traitement complet, sans complication, avec résolution de l'infection. La durée moyenne du séjour hospitalier a été de 10,9 jours, contre 23,6 jours de traitement en externe. Chez 15 patients, le traitement à domicile a été cessé en raison d'une détérioration clinique : réactions indésirables au médicament (n = 2), phlébite (n = 2), environnement non conforme (n = 1), non-observance (n = 1), infection de la ligne (n = 1) et décès de cause indépendante (n = 1). Globalement, on a signalé 15 réactions indésirables aux médicaments pour l'ensemble des 2 534 jours-patients du traitement répartis sur 18 mois. L'analyse des coûts a révélé un coût de 0,12 \$ au dollar en comparaison avec le traitement hospitalier.

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Intravenous antibiotic therapy at home or received through an infusion clinic was developed in the 1970s to meet the increasing demands on hospital bed space, to provide parenteral antibiotic therapy at reduced expense and to allow patients to receive this therapy in the more desirable surroundings of their own homes with their families (1-4).

In the United States, with health care funding provided by private third-party insurers, this option for care was enthusiastically and rapidly embraced because it reduced the payers' expenditures for each patient (2-6). In Canada, with universal medicare, the impetus for provincial governments to prioritize outpatient intravenous antibiotic therapy programs was not as strong because, with virtually 100% utilization of hospital bed space, as soon as one patient was discharged to home treatment, a new, usually sicker patient (requiring additional investigative and treatment expenses) would immediately occupy the bed. Thus, no actual cost saving was realized, only the increased efficiency of health care delivery. The latter advantage was not always given highest weight in the minds of health care economists watching the bottom line. Recently, with constraints on health care spending driving hospital bed closures, administrators have seen outpatient intravenous (IV) antibiotic therapy as a partial 'pressure release valve'. Hence, despite the availability of home intravenous antibiotic therapy in provinces such as Manitoba since the late 1970s, British Columbia only recently formally structured this therapy into regional home care programs in 1995. This came about with restructuring of the provincial health care administrative services into regional health boards. In the Vancouver region, under the auspices of the Ministry of Health, the Vancouver Regional Health Board (now the Vancouver-Richmond Regional Health Board) instituted a grant competition entitled "Closer to Home", through which a proposal for a region-wide, home-based outpatient intravenous antibiotic therapy program was submitted jointly by Vancouver region hospitals and the Continuing Care Division of the Vancouver Regional Health Board. Funds were awarded and the program began in mid-1995. In the following report, most of the data comes from the Vancouver Hospital and Health Sciences Centre (VHHSC) program, with which the authors work directly. Other hospital participants in the region include St Paul's Hospital, St Vincent's Hospital, Mount St Joseph's Hospital and BC's Children's Hospital.

LOGISTICS

Four categories of patients assessed for outpatient IV antibiotic therapy VHHSC (which includes the Vancouver General Hospital and the University of British Columbia Acute Care Unit on the University of British Columbia campus) were identified.

- **Category 1:** Patients living in Vancouver and treated at home under the VHHSC program.
- **Category 2:** Patients living outside of Vancouver but treated under the VHHSC program (see below).
- **Category 3:** Patients discharged from VHHSC back to their own region for treatment.

- **Category 4:** Patients who are screened and found to be inappropriate candidates for out-patient IV therapy.

A team approach is essential with all home care IV antibiotic programs. At VHHSC, the home IV team consists of the infectious diseases (ID) specialist, clinical nurse educator, home IV clinical pharmacist and the home care liaison. First, patient enrolment involves the screening of potential candidates for the necessity for and type of antibiotic regimen. In the VHHSC program, the screening is done by the ID service in conjunction with the home IV clinical pharmacist. Second, each patient is assessed for intravenous access by the clinical nurse educator, skilled in catheter placement and maintenance. Depending on the antibiotic regimen, a peripheral catheter, peripherally inserted central catheter (PICC), Hickman line or Port-a-cath (Bard Access Systems, Salt Lake City, Utah) will be recommended, with or without the use of a computerized automatic drug delivery (CADD) pump (7). Patient education regarding IV infusion and care of the catheter is usually initiated in the hospital with the clinical nurse educator and then continued by home care nurses in the community. The goal is to teach the patient to be self-administer the antibiotic therapy, although in some cases the home care nurse may be able to administer the IV for the entire duration of therapy. The home IV clinical pharmacist educates the patient regarding their antibiotics and goals of therapy. Once the indications for IV therapy have been confirmed and the line type selected, the patient's home environment is reviewed and the home IV team, in collaboration with the home care liaison nurse, coordinates the community home care nursing support. A screening form is filled out by the home IV team indicating the type of infection, antibiotic therapy completed to date, planned antibiotic regimen at home, oral or intramuscular regimens that could be used temporarily in case of loss of IV access, previous gentamicin or vancomycin levels, and serum creatinine concentrations.

A patient's place of residence determines where they will receive therapy. For example, if a patient lives in Vancouver but has received hospital treatment at the Burnaby General Hospital, any continuing outpatient IV therapy would be the responsibility of the Vancouver regional program. In this case, the Vancouver regional program requires the attending physician to consult an ID specialist in the Vancouver region who, along with the home IV team, screens the patient for suitability and discusses the follow-up plan with the attending physician. Incoming referrals from another region's ID specialist are automatically enrolled upon receipt of a screening form from that individual. If the patient is to be discharged from a Vancouver region hospital to their home region, this form is faxed to the patient's attending physician and the designated outpatient parenteral therapy coordinator for the home region, preferably an ID specialist.

The Vancouver regional program is hospital-based, but the drug formulation and delivery coordination is performed centrally at St Paul's Hospital Pharmacy. The exception is the BC's Children's Hospital, which prepares its own antibiotic doses. Selected antibiotic regimens are faxed to the central

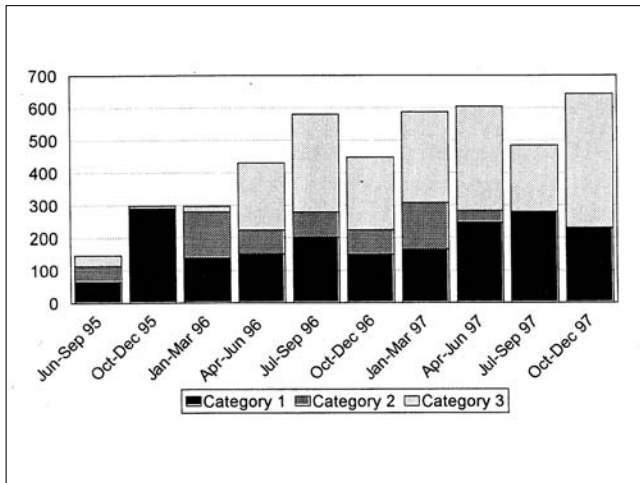


Figure 1 Total number of completed days of therapy through the Vancouver Hospital and Health Sciences Centre (VHHSC) program by patient category. Category 1 includes patients living in the Vancouver health region, Category 2 includes those patients living outside the Vancouver region but for technical reasons treated under the VHHSC outpatient program and Category 3 includes those patients discharged from VHHSC to their home region for completion of intravenous antibiotic therapy

TABLE 1
Vancouver Hospital and Health Sciences Centre (VHHSC) home intravenous program screening outcome

Screening outcome	Patients (%)
Accepted to Home IV Antibiotic Program	190 (57)*
VHHSC program – Vancouver region patients (Category 1)	83 (44)
VHHSC program – non-Vancouver region patients (Category 2)	24 (12)
Non-Vancouver regional program (Category 3)	83 (44)
Non-home intravenous candidates (Category 4)	144 (43)*
Remained on inpatient parenteral therapy	74 (51)
Discharged on oral antibiotics	34 (24)
Referred to medical daycare	27 (19)
Antibiotics not required or discontinued	7 (5)
Left against medical advice	2 (1)
Total	334 (100)

*Percentage of grand total

pharmacy from other users in the region. A contracted home care drug delivery service (Caremark) assures that supplies are sent to each patient's home. Antibiotics in infusion bags are kept frozen or refrigerated until needed.

At VHHSC, the infections are usually complex, and it is preferred to have regular contact with patients for the medical supervision of the treatment, monitoring of patient tolerance and compliance with the therapy, as well as for the monitoring of devices such as PICC lines and CADD pumps with which home care nurses may be less familiar.

To ensure continuity of care, each patient in the VHHSC program is followed once per week by the home IV team (an ID physician, clinical nurse educator and the home IV clinical pharmacist) and a letter is sent to the attending physician on

TABLE 2
Vancouver Hospital and Health Sciences Centre home intravenous program antibiotic usage

Home intravenous antibiotics	Patients (%)
Vancomycin +/- other antibiotic	33 (31)
Cloxacillin +/- gentamicin	23 (21)
Ceftriaxone +/- gentamicin	13 (12)
Cefazolin	11 (10)
Penicillin +/- other antibiotic	9 (8)
Ceftazidime + tobramycin or gentamicin	7 (7)
Gentamicin	4 (4)
Piperacillin + tobramycin	3 (3)
Other*	4 (4)
Total	107 (100)

*Includes ganciclovir (2), foscarnet (1), amphotericin B (1)

the patient's treatment status. The plan for follow-up at other hospitals in the Vancouver region varies, and patients may be seen by an ID specialist or their family doctor or another specialist.

PROGRESS TO DATE

The regional program officially began in April 1995. As of April 1998, 606 patient courses of intravenous antibiotics have been administered to the Vancouver region adult patients. Figure 1 depicts the distribution of patients enrolled from June 1995 to December 1997 in the VHHSC program. At VHHSC, a province wide referral centre, a significant number of patients come from areas outside of Vancouver (Table 1). Of the 190 patients enrolled through the VHHSC program from June 1995 to December 1997, 83 or 44% were Vancouver residents (Category 1). For special technical reasons, 24 (12%) out of region patients (Category 2) were followed by the VHHSC home IV team. Eighty-three (44%) were discharged to other regions (Category 3). Through the screening process, 34 of 144 patients not enrolled in the VHHSC program were switched to an effective oral antibiotic regimen and discharged from hospital. Had it not been for the ID service and pharmacy evaluation, it is likely that these 34 patients would have remained in hospital on intravenous antibiotics.

Table 2 lists the types of antibiotics administered. Because orthopedics was a heavy user of outpatient treatment, as in most programs, and VHHSC is a centre for reconstructive *Staphylococcus aureus* was rare. The preferred catheter for duration of infection-free, phlebitis-free days was the PICC line (Table 3). These devices are inserted using maximum sterile barrier techniques (cap, gown, mask, sterile gloves and a large drape), but not in an operating room. All insertion sites are cleaned with 0.5% hexachlorophene and covered with a sterile operative-site dressing. The lines are evaluated, and dressings are changed weekly. In the VHHSC experience, complications related to the IV catheters are infrequent. Only one of the 107 catheters inserted resulted in sepsis. This occurred in a patient whose line had been left in place pending ongoing medical evaluation after completing his antibiotic course. In 10 patients, the catheter became blocked, and five of these required a streptokinase flush to clear

them. Five catheters were associated with inflammation along the cannulated vein within the first five days after insertion, but were not removed. The presumably mechanical phlebitis resolved with warm compresses.

The majority of parenteral therapy was completed at home. The average duration of hospital therapy was 10.9 days (median nine days) versus 23.6 days (median 19 days) of outpatient therapy. Ninety-two patients (86%) completed their required course of therapy, one requiring some modification. In 15 patient courses (14%), home treatment was discontinued due to noncompliance by one patient, clinical deterioration in seven, adverse drug reaction in two, intravenous line problems in three and death due to noninfection-related causes in one. Adverse drug reactions occurred in 15 patients.

FUTURE PLANS

The demand for outpatient IV antibiotic therapy will increase as British Columbia expands medical home care treatments and services. We foresee expansion of CADD pump use allowing frequent dosing interval agents and increased use of PICC lines, which will require the training of nurses in other regions. A future goal is to establish practical ways of enabling outpatients to function in rural areas of British Columbia, with a strong support network among all the various provincial centres through such means as the newly created Vancouver Hospital Pharmaceutical Sciences website.

At present, the VHHSC program has demonstrated a cost-benefit ratio of 12 cents on the dollar compared with in-hospital IV antibiotic therapy (8). Based on this data, the re-

TABLE 3
Parenteral administration devices used in the Vancouver Hospital and Health Sciences Centre (VHHSC) outpatient antibiotic program

Characteristic	VHHSC (Category 1&2) (%)	Non-Vancouver region (Category 3) (%)
Infusion device		
No infusion device used	72 (67)	80 (96)
CADD Plus pump (SIMS Deltec Inc, St Paul, Minnesota)*†	35 (33)	3 (4)
Total	107 (100)	83 (100)
Catheter type		
PIC	61 (57)	34 (41)
Peripheral line	20 (19)	18 (22)
Port-a-cath (Bard Access Systems, Salt Lake City, Utah)	12 (11)	10 (12)
Central line	14 (13)	21 (25)
Total	107 (100)	83 (100)

*Antibiotics given more than four times daily or infusion device required for infusion. †For six patients, two medications were given; one by pump and one by gravity. CADD Computerized ambulatory drug delivery; PIC Peripherally inserted catheter

gional board is expected to expand funding for the increasing patient load for this strong hospital-community care partnership initiative.

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