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As well as several interesting Australian publications ranging from a recent publication on continuous infusions of ticarcillin-clavulanate (Timentin®) in HITH to a randomised control trial of the effect of HITH on physical and emotional function in the elderly, this issue also includes a listing of an informative series of articles on wound management from the British Medical Journal. There are also other recently published articles on continuous antibiotic infusions including an article from New Zealand looking at the effects of chilling on the stability of benzylpenicillin.

Most of the articles listed in this review are available either from libraries in Australia or journal websites. Copies of articles with an asterisk (★) can be requested from ACA if required for educational or research purposes by using the order form available on the website.

We hope you find the HITH Review to be a valuable resource and we would welcome any contributions or any feedback.

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## Continuous Infusions

Lisa Demos

Munckhof WJ, Carney J, Neilson G et al. Continuous infusion of ticarcillin-clavulanate for home treatment of serious infections: clinical efficacy, safety, pharmacokinetics and pharmacodynamics. *Internat J Antimicrob Agents* 2005; 25:514-22. ★

This study incorporated a 6-year retrospective arm evaluating efficacy and safety of continuous infusion (CI) ticarcillin-clavulanate in the home treatment of serious infections and a prospective arm additionally evaluating pharmacokinetics (PK) and pharmacodynamics (PD). Patients received the same total daily dosage at home as a continuous infusion as they had received in hospital as an intermittent infusion. In the prospective arm, steady-state serum ticarcillin and clavulanate levels and MIC testing of significant pathogens were performed.

One hundred and twelve patients (median age, 56 years) were treated with a CI dose of 9.3-12.4g/day and mean CI duration of 18.0 days. Infections treated included osteomyelitis (50 patients), septic arthritis (6), cellulitis (17), pulmonary infections (12), febrile neutropenia (7), vascular infections (7), intra-abdominal infections (2), and Gram-negative endocarditis (2); 91/112 (81%) of patients were cured, 14 (13%) had partial response and 7 (6%) failed therapy. Nine patients had PICC line complications and five patients had drug adverse events. Eighteen patients had prospective PK/PD assessment although only four patients had sufficient data for a full PK/PD evaluation (both serum steady-state drug levels and ticarcillin and clavulanate MICs from a bacteriological isolate), as this was difficult to obtain in home-based patients, particularly as serum clavulanate levels were found to deteriorate rapidly on storage. Three of four patients with matched PK/PD assessment had free drug levels exceeding the MIC of the pathogen.

Home CI of ticarcillin-clavulanate is a safe, effective, convenient and practical therapy and is a therapeutic advance over traditional intermittent dosing when used in the home setting.

comment

Although there are several limitations with the study design this Australian study from Prince Alexander Hospital in Queensland provides further experience with continuous infusions of beta-lactams in the management of patients with a range of serious infections in HITH and new published evidence for the combination of beta-lactam and beta-lactamase inhibitor.

Overall ticarcillin-clavulanate CI appeared to be efficacious however 23% of the patients received additional IV antimicrobials and some continued on with oral antibiotics. Unfortunately only a small number of patients had pharmacokinetic/pharmacodynamic assessment available. Complications of antimicrobial therapy included 3 patients with eosinophilia, 1 patient with *Clostridium difficile* diarrhoea and one patient developed gentamicin nephrotoxicity.

Another publication cited in this HITH Review supports the administration of another antibiotic (meropenem) as a continuous infusion though this is administered in the hospital setting.

### Reference

Lorente L, Lorenzo L, Martin MM et al. Meropenem by continuous versus intermittent infusion in ventilator-associated pneumonia due to gram-negative bacilli. *Ann Pharmacother* 2006; 40:219-23. ★

## Stability Benzylpenicillin Infusions

Lisa Demos

Vella-Brincat J, Begg E, Zhang M et al. Cooling enhances benzylpenicillin stability during continuous home intravenous administration. *Hosp Pharm* 2006; 13:56-7. ★

This New Zealand article investigated the effects of chilling on the stability of benzylpenicillin sodium in NaCl 0.9% during simulated home IV therapy.

Five volunteers wore reservoirs placed inside a Paragon pump for 24 hours. Two reservoirs were worn for each 24 hour period-one inside a standard home intravenous therapy "belt-bag" (control) and one inside

an insulated bag containing frozen packs (chilled.) The frozen packs consisted of frozen water or frozen gel and were renewed at 12 hours. A TinyTag thermometer was present in all bags.

Temperatures were recorded each minute, benzylpenicillin samples were taken at timed intervals and concentrations were measured by HPLC.

The mean temperatures recorded were 28.5°C (controls, two volunteers), 20°C (chilled with frozen water) and 17.4°C (chilled with frozen gel). The mean percentages of the initial concentration of benzylpenicillin left at 12 hours were 87.5% (controls), 102.4% (frozen water) and 97.4% (frozen gel). Those at 24 hours were 43.7% (controls), 82.3% (frozen water) and 86.6% (frozen gel). The percentage of the initial concentration of benzylpenicillin left at 24 hours was greater in both the frozen water ( $p < 0.007$ ) and the frozen gel bags than in the controls ( $p < 0.001$ ).

Chilling benzylpenicillin during home IV therapy with insulation and frozen packs increases its stability.

## comment

This small study reinforces the temperature dependent degradation of benzylpenicillin. The results are quite relevant to HITH where infusion devices are often worn next to the patient's body. In this study the controls recorded average minimum and maximum 24 hour temperatures ranging from 18.3°C to 34.1°C with maximum temperatures recorded at night when the bags were worn under bedclothes. It is likely that lower temperatures would be achieved if the bags are placed outside the bed overnight with a corresponding increase in the percentage of benzylpenicillin left at 24 hours. Although this study supports greater stability of benzylpenicillin as a result of cooling to get a better understanding of its stability under various conditions this study would need to be repeated using different infusion devices, with the bags outside the bed and in hotter climates.

## Cellulitis

Lisa Demos

Donald M, Marlow N, Swinburn E, Wu M. Emergency department management of home intravenous antibiotic therapy for cellulitis. *Emerg Med J* 2005; 22: 715-7. ★

A retrospective analysis was undertaken to evaluate the safety and efficacy of using intravenous cephazolin as a first line antibiotic for the treatment of cellulitis in a supervised outpatient programme. All patients who attended the emergency department (ED) of a Sydney hospital over the period of 1 year and satisfied the following inclusion criteria: (a) age >16 years, (b) presented with acute cellulitis, and (c) were suitable for home intravenous antibiotic therapy according to APAC guidelines were included.

In total, 124 patients were included, 53 (42.7%) presented directly to the ED and 71 (57.3%) were referred by their general practitioner. Of these 124 patients, 75 (60.5%) were men and 49 (39.5%) were women. Age range was 16-97 years. There were 82 (66.2%) presentations of cellulitis of the lower limb, 30 (24.2%) of the upper limb, 9 (7.2%) of the face and 3 (2.4%) of the torso. Cephazolin 2 g twice daily was given to 123 (99.2%) of the patients, and one patient (0.8%) received ceftriaxone 2 g once daily. In total, 105 patients (84.7%) were treated successfully and 19 (15.3%) were re-admitted. Four of the unsuccessful treatment group required incision and drainage of abscesses. The mean duration of intravenous therapy was 6.24 days. One patient developed diarrhoea. There were no other complications attributable to therapy.

Low re-admission rates verify the efficacy of cephazolin 2 g twice daily in treating cellulitis in the home environment. Benefits include economic savings and reduced risk of nosocomial infection.

## comment

This paper provides further experience with cephazolin 2g twice daily in the management of cellulitis in HITH patients. We noted that the duration of therapy was less than the 7.3 days we previously reported in Victorian HITH patients managed for cellulitis. Interestingly 13 patients required readmission due to failure of cellulitis to resolve therefore the indication for cephazolin in HITH patients may require review.

## Relevant abstracts from Medline and Cinahl

### HITH vs. hospital management of exacerbations in CF patients

Esmond G, Butler M, Mc Cormack AM. Comparison of hospital and home intravenous antibiotic therapy in adults with cystic fibrosis. *J Clin Nurs* 2006; 15:52-60. ★

The aim of this study was to compare the clinical outcome and quality of life in adult cystic fibrosis (CF) patients receiving intravenous (IV) antibiotics for acute respiratory exacerbations in home to hospital treatment.

A quasi-experimental design was used with pre- and post-test clinical outcome measures of forced expiratory volume in one second (FEV(1)), forced vital capacity (FVC), oxygen saturations (SaO(2)), body mass index (BMI) and quality of life using the CF Quality of Life (CFQoL) questionnaire.

Thirty adult CF patients (15 hospital and 15 home) were recruited once they had chosen where they undertook their treatment. When the groups were compared for clinical outcomes, the hospital group showed greater improvement in FVC. There were no differences in quality of life when the hospital and home groups were compared, although changes achieved with treatment showed differences. In the home group, there were improvements in all nine quality of life domains, with statistically significant improvement in five domains, whereas in the hospital group there were improvements in eight out of nine quality of life domains, with only two showing statistically significant improvement.

Lung function improved more in the hospital group, suggesting that acute respiratory exacerbations were not as effectively treated at home, although there was a greater quality of life with home treatment. The CFQoL questionnaire was able to detect transient changes in health status during the course of IV antibiotics.

If the patient's right to choose where they receive treatment is to be supported, taking into account quality of life further research is required to determine the reasons for home care being less clinically effective in treating acute respiratory exacerbations in CF patients.

### Vancomycin in HITH

Fraser TG, Stosor V, Wang Q et al. Vancomycin and home health care. *Emerg Infect Dis* 2005; 11:1558-64. ★

This retrospective cohort study evaluated parenteral vancomycin use in patients receiving it through a homecare agency against the Hospital Infection Control Practices Advisory Committee guidelines.

39.2% of outpatients received vancomycin outside the guidelines, mainly because of prolonged empiric therapy, dosing convenience, and prolonged use after surgery. Patients were more likely to receive vancomycin appropriately if they were >65 years of age, had a history of malignancy, or were discharged from a medical service. In addition, obtaining wound cultures and attempting a microbiologic diagnosis led to more appropriate vancomycin use. Recommendations for prudent vancomycin use are often overlooked when selecting antimicrobial drugs for home infusion. The public health impact of this practice remains unknown.

### Pressures on Nurses in HITH

Duke M, Street A. Tensions and constraints for nurses in hospital-in-the-home programmes. *Internat J Nurs Pract* 2005; 11:221-7. ★

The aim of this publication was to generate discussion concerning the tensions that exist for nurses who practice in the home under the auspices of acute-care institutions. Data drawn from field work that formed part of a critical ethnography is used to generate the discussion. The larger research project explored the constructions of the role of the nurse in four Victorian Hospital-in-the-Home programmes. It will be argued that there is significant pressure exerted upon nurses to support the imperative to reduce bed days in acute hospitals by transferring people to their home. At times, this agenda clashes with the nurses' professional commitment to provide holistic patient care, yet the dilemmas are largely unacknowledged and/or unrecognized by the nurses despite the tension they generate.

## RCT of HITH on Physical and Cognitive Function in the Elderly

Caplan GA, Coconis J, Woods J. Effect of hospital in the home treatment on physical and cognitive function: a randomized controlled trial. *J Gerontol* 2005; 60A(8): 1035-8. ★

Hospitalization for acute illness is associated with higher rates of mortality and morbidity, as well as functional decline, for older patients. We have previously shown that treatment in Hospital in the Home (HITH) results in less confusion and fewer bowel and bladder problems for these patients. However, it is not clear what impact HITH has on physical and cognitive function. One hundred patients (mean age 70) presenting to the emergency department and assessed by a senior doctor to require admission were randomized to be treated in hospital or at home. We measured the Barthel index, Instrumental Activities of Daily Living (IADL) index, and Mental Status Questionnaire (MSQ) on admission and at discharge.

The HITH-treated group improved in the IADL and MSQ indices, whereas the hospital-treated group improved only in the MSQ. The improvement in IADL scores remained significant after adjusting for age, sex, living arrangements, development of confusion, and length of stay.

HITH offers a safe option for treatment of older patients with a functional advantage over in-hospital care.

## List of Medline, Cinahl and other relevant published articles

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