Evaluating the Use of Continuous Infusion Elastomeric Pumps as a Replacement for Mechanical Infusion Pumps

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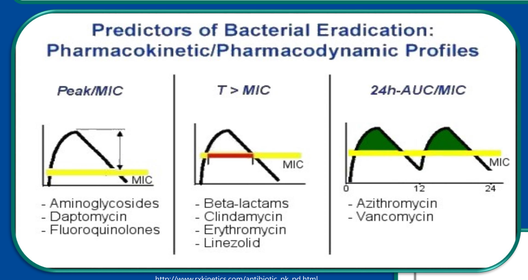
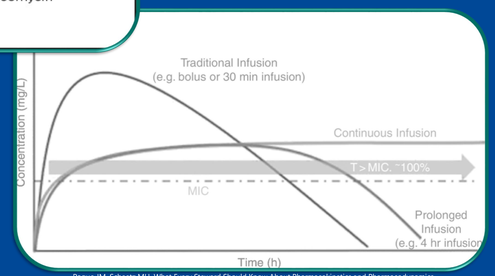
Background

- Home Infusion pharmacists play a key role in determining appropriate drug delivery devices to best treat the patient based on: cost, indication, caregiver support, and other patient-specific factors.
  - Mechanical infusion pumps are often used for patients with multiple daily doses.
- Mechanical infusion pumps are associated with known issues including: increased cost, coordination of pump return, pump malfunction, user error, and pump maintenance.
- An elastomeric pump is a non-electric pump with a balloon-like drug reservoir and tubing with a flow restrictor. Elastomeric pumps are single use pumps.
  - Elastomeric pumps are available via multiple manufacturers in formats that support continuous infusion dosing strategies (e.g. 270mL nominal fill volume, 10mL/hr infusion rate).
- Many common outpatient IV antibiotics exhibit time-dependent killing, meaning the goal is to maximize the duration of antibiotic exposure. Maximum bactericidal effects are usually seen when the time above the minimum inhibitory concentration (MIC) is >70% of the dosing interval ("**T>MIC**").
  - The majority of the supportive data for these modalities is based on inpatient setting and in critically-ill patients.



http://www.rxkinetics.com/antibiotic_pk_pd.html



Pogue JM, Scheetz MH. What Every Steward Should Know About Pharmacokinetics and Pharmacodynamics.

Methods

- Pharmacy student evaluated treatment populations that would be appropriate for CI/EI antibiotics
- Common antibiotics used by the organization were analyzed for compatibility in a CI elastomeric pump
- A cost comparison between the CI elastomeric & mechanical infusion pumps was completed.
  - The difference between the elastomeric pump and the ambulatory mechanical pump was determined to be the potential cost savings
  - Cost savings were evaluated for significance using a paired t-test
- Stability data was compiled to determine appropriate beyond use dating, and evaluated against normal dosing protocols for practicality
- The antibiotics that were chosen were determined to be acceptable to use in the home if they were:
  - Compatible in an elastomeric device at standard dosing / concentrations
  - If the stability at room temperature was at least 1 day
  - If the refrigerated stability data was at least 7 days
- Results of this project were shared with Home Infusion team, intake nurses, and Infectious Disease providers, nurses, and pharmacists

Results

- EI / CI was found to be most relevant for those with structural lung disease, frequent healthcare exposure, prior antibiotic exposure, critical illness with infection, & infections due to pathogens with high intrinsic resistance or tendency for developing resistance (e.g. Serratia, Pseudomonas, Burkholderia, Acinetobacter, E. coli)
- 10 medications were found to be compatible with CI Elastomeric format and appropriate for utilization.

- 2020 n=113 services provided on mechanical infusion pump that met the criteria to be provided on a CI elastomeric pump (average length of therapy = 30 days).
- The mean cost per service for a CI elastomeric pump was $342.05 versus mechanical pump cost of $417.50 ($p<.05$).
- CI elastomeric pumps would have resulted in a cost savings of $8,526 in supply costs during 2020.
- Cost estimates do not include other potential savings related to workflow efficiencies (compounding, maintenance/calibration), or the loss of a mechanical pump

Medication	CI Pump Compatible	Conc. Data (PM)	Conc. Data (AM)	Conc. Relative to CI Pump (240mL)*	Typical Daily Dose	RT Stability	Refrigerated Stability (PM)	Refrigerated Stability (AM)	Reference
Aztreonam	Y	10-30 mg/mL	60 mg/mL (AM1)	2.4-14.4 g/day	3-6 g/day	1 day	7 days	28 days (AM1)	1
Cefazolin	Y	16.7 mg/mL	5-40 mg/mL (AM2)	1.2-9.6 g/day	6 g/day	1 day	14 days	10 days (AM2)	2
Cefepime	Y	20 mg/mL	5-60 mg/mL (AM3)	1.2-14.4 g/day	4-6 g/day	1 day	14 days	14 days (AM3)	4
Cefoxitin	Y	1-10 mg/mL	5-60 mg/mL (AM2)	1.2-14.4 g/day	4-8 g/day	2 days	7 days	10 days (AM2)	5
Ceftazidime	Y	40 mg/mL	5-40 mg/mL (AM1)	1.2-9.6 g/day	3-6 g/day	1 day	14 days	14 days (AM1)	1
Ceftolozane/Tazo.	Y	1.5-3 mg/mL	37.5 mg/mL (AM4)	0.36-9 g/day	4.5-9 g/day	1 day	14 days	7 days (AM4)	6
Clindamycin	Y	6-12 mg/mL	-	1.4-2.9 g/day	0.6-2.7 g/day	3 days	30 days	-	8
Nafcillin	Y	50 mg/mL	10 mg/mL (AM2)	2.4-12 g/day	6-12 g/day	2 days	14 days	14 days (AM2)	3
Penicillin G	Y	20,000-100,000 IU/mL	-	4.8-24 MIU/day	18-30 MIU/day	1 day	14 days	-	7
Piperacillin/Tazo.	Y	10-90 mg/mL	-	2.4-21.6 g/day	18 g/day	1 day	28 days	-	3

CI = Continuous Infusion; PM = Primary Manufacturer; AM = Alternative Manufacturer; RT = Room Temperature

2020 Supply Costs (N=113)	
$ 47,178	Mechanical Pump
$ 38,652	CI Elastomeric Pump
$ 8,526	Difference

Estimated Cost of Therapy - 30 days supply	
Cost	**Deliver Mechanism**
$ 642	EI Elastomeric - 3/day
$ 461	Mechanical Infusion Pump
$ 429	EI Elastomeric - 2/day
$ 342	CI Elastomeric
$ 108	IV Push - 3/day

Objectives

The purpose of this project was to evaluate the use of 24-hour continuous infusion (CI) elastomeric pumps as a replacement for mechanical infusion pumps. The objectives for the project were to:

- Evaluate common home infusion antibiotics to determine medications and indications that would be acceptable to give as a continuous infusion.
- Evaluate the stability of medications and dosages that would be appropriate to practically provide via a CI elastomeric pump.
- Creation of a guideline to standardize our organizations use of CI elastomeric pumps versus mechanical pumps.
- Perform a cost savings analysis to compare the cost of treatment with a mechanical pump versus a CI elastomeric pump

Discussion

- CI/EI antibiotics may be clinically appropriate to provide for patients receiving home infusion antibiotic therapy
- CI 24 hour elastomeric pumps are an option that may be practical for indication and preparation of many antibiotics
- Continuous elastomeric pumps are shown to be significantly less expensive than providing continuous / extended infusions via a mechanical infusion pump.

- When clinically indicated, a CI elastomeric delivery system should be considered as a cost effective, efficacious, and patient friendly option
- As home infusion continues to grow & options advance, it is important to stay up to date to best serve patients & make cost effective decisions on drug delivery devices
- Continuous infusion elastomeric pumps may provide a significant cost savings to the organization an improved patient experience

- **Future studies should include evaluation of workflow efficiencies, patient satisfaction, and the failure rate of these pumps**

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Disclosures: The authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities