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 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.

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.

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
• Stability data was compiled to determine appropriate beyond use dating, and evaluated against normal dosing protocols for practicality
• The antibiotics that were chosen to be determined were 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

• CI/EI 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 pumps 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<0.05)
• 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

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 programs grow & options advance, it is important to stay up to date to continue 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.