IMPACT OF HOSPITAL TRANSPORT SYSTEMS, INCLUDING PNEUMATIC TUBES, ON PROTEIN STABILITY IN IV BAGS AND SYRINGES

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Background and Importance

Centralized hospital compounding ensures high-quality standards and financial benefits through vial sharing. However, reconstituted medications must be transported to wards using methods not always covered in product specifications and handling stress may be detrimental to protein drugs[1]. Pneumatic tube systems (PTS) can generate high particle levels from protein aggregation impacting drug stability[2], but for certain formulations PTS may be safe.[3] Further investigations are needed.

Aim and Objectives

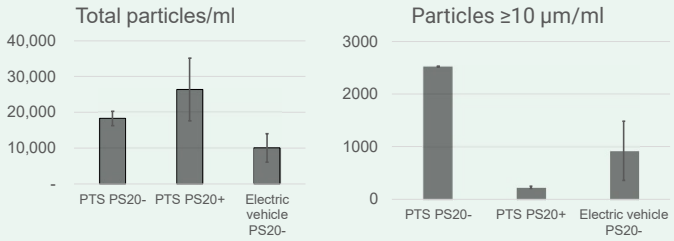
To evaluate the impact of pneumatic tube transport versus electric platform truck delivery on protein stability in IV bags and syringes in a hospital setting.

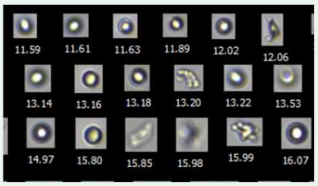
Materials and Methods

Transport methods: PTS vs. electric platform truck
Products: Trastuzumab diluted in saline IV bags
Insulin repackaged in siliconized syringes with or without Polysorbate 20 (PS)

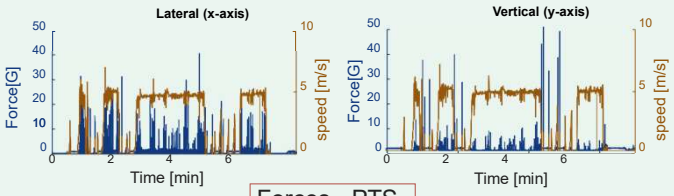
Methods for data collection:
Smart labels for shock and vibration monitoring
Flow Imaging Microscopy (FIM),
Size-Exclusion Chromatography (SEC)
Visual inspection for particle formation

Results





Subvisible particles after transport, spherical likely silicone oil from syringes. Data from FIM measurements. Area based diameter (µm) in white.



Forces - PTS

Shock sideways during movement 10-20G

Shock occurring in transfer/receiving stations 20-50G

Forces – Electric truck
Maximum remained below 5 G

- PTS increased total subvisible particles in IV bags, especially when headspace was present.
- Syringes transported via PTS had higher levels of spherical particles, likely from silicone oil.
- Surfactant (PS20 0.01%) reduced particles ≥10 µm but increased total particle count.
- Electric platform truck transport had minimal impact on particle formation.

Conclusion and Relevance

Pneumatic tube transport introduces mechanical stress, leading to increased particle levels in IV bags and syringes. Removing headspace in IV bags is an effective strategy to mitigate particle formation. The impact is more pronounced for sensitive formulations, where even minor agitation can compromise stability. Pharmacists and nurses should be aware of the effects of transport methods on drug stability and best practices to minimize risks.

What does this mean for hospital pharmacists?

- Consider to minimize headspace in IV bags since removing air headspace significantly reduces subvisible particle formation.

References and Acknowledgements

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2. Linkuviené et al. J Pharm Sci 2022 DOI 10.1016/j.xphs.2022.01.016
2. Hendrickx et al. 2023 BJHP 1 Feb 2024

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