

IS PNEUMATIC TUBE DELIVERY SAFE FOR MEDICINES?

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OBJECTIVES

Sending drugs by pneumatic tube system is an efficient alternative in large hospital areas, especially in emergency cases. Modern systems are high-speed constructions and create high gravitational forces on the products. The challenge is to predict, if this causes quality damage during transport. Therefore we examined the impact on the stability of primary packaging, on various pharmaceutical preparations and also on active ingredients.

METHODS

We sent different pharmaceutical preparations (e.g. powders, ointments, emulsions) wrapped in various packaging materials by pneumatic tube system. We simulated worst case conditions by choosing most remote ward, conducting more than three transports per product and using different load conditions. Gravitational forces were evaluated by accelerometer.

Afterwards we checked the integrity and stability of the products following pre-defined specifications documented in our operational qualification (OQ) plan.

A complementary literature research was performed to identify instable molecules that may not be delivered by pneumatic tube system.

BACKGROUND INFORMATION

g-force (gravitational force):

A force acting on a body as a result of acceleration or gravity, informally described in units of acceleration equal to one g.

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Examples:

Standing on the Earth at sea level—standard: 1g

Space Shuttle, maximum during launch and re-entry: 3g

Maximum permitted g-force turn in Red Bull Air Race plane: 10g

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Ergebnisbericht OQ Rohrpostanlage		Universitätsklinikum ST. PÖLTEN				
Prüfpunkt Nr.	Prüfpunkt	Prüfanweisung	Akzeptanzkriterium	Ergebnis	Entspricht	Datum / Unterschrift
6	Auswirkung des Transports auf die Qualität der Arzneimittel	Rohrposthülsen mit unterschiedlicher Beladung werden von Sendestation in der Apotheke an die am weitesten entfernte Empfangsstation im Haus C gesendet. Unterschiedliche Verpackungsmaterialien werden verwendet.	Transporttemperatur zwischen 15-25°C		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Keine sichtbare Beschädigungen an Ware und/oder Verpackung		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Verdacht auf Mikrorisse bei Ampullen bzw. Durchstechflaschen		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Austritt von Inhalt		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Qualitätsmindernde Pulververteilung		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Entmischung		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Kuchen- oder Sedimentbildung		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Defekte an Infusionszubehör		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	
			Veränderte Infusionsrate		<input type="checkbox"/> Ja <input type="checkbox"/> Nein	

RESULTS

During the conducted 60 rides maximum g-force measured was 16g.

Based on literature research we excluded protein based drugs like monoclonal antibodies because of their low tolerance against physical stress and the limited analytic methods in a hospital pharmacy.

For safety reasons we excluded also cytotoxic drugs, dangerous goods and compressed-gas containers.



There is no negative impact on solid oral dosage forms like capsules and tablets in blister or bulk just as on solutions.

Glass as primary packaging causes no problems when wrapped safely.

Ampules showed no hair cracks.

Refrigerated goods stay in temperature range during transportation period.



Powder or ointments leak from plastic containers.

Multi-phase formulations tend to separate.

Powder in ampules is irreversibly compressed into the head of the ampule.

Emulsions are destroyed by increasing viscosity.



CONCLUSION

Because of strong g-forces the risk to damage packaging is high in pneumatic tube delivery, but it can be reduced by using particular packaging materials. But besides that the impact on the active substance and on the pharmaceutical preparation has to be considered. Pharmacists have to bring in their skills in this process. It's on them to release guidelines and SOPs, that define, which active pharmaceutical ingredient and which dosage form can be transported under these conditions.

Patients benefit from hospital pharmacists in the distribution chain, as they ensure safety, quality and efficacy of medicines all over the process.



References:

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Lim JY, Kim NA, Lim DG, Kim KH, Jeong SH. Effects of thermal and mechanical stress on the physical stability of human growth hormone and epidermal growth factor. Archives Of Pharmacal Research. 2015;38(8):1488-1498. doi:10.1007/s12272-014-0521-3.