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Molecular Weight Characteristics of Icodextrin and its Mechanism on Water Transportation

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Introduction

- Icodextrin is often employed as an osmotic agent in continuous ambulatory peritoneal dialysis (CAPD).
- The mechanism of water transport induced by this glucose polymer solution is yet to be completely elucidated.

Objectives

- To demonstrate the effect of "Crystallized" mechanism on ultrafiltration induced by small glucose in icodextrin, and how this effect is related to the effective membrane pore size.

Methods

- Using experimental and simulation models.
- Cellophane bags with MW cut-off being 30 kDa (providing the size of small pores), the peritoneum and 3.5 kDa containing 7.5% icodextrin solution were placed in plasma.
- Twenty-four hour monitoring of mass changes and its calculation were performed.

Action	Design	Working	Measurement	Analysis
ICD	ICD	ICD	ICD	ICD

- Mass distributions of solutes inside and outside cellophane bags at the beginning and at 24-hour incubation were analyzed using HPLC.
- Computer simulation model of ultrafiltration induced by icodextrin solution.

Transport Significance	
Peritoneal Dialysis	ICD
ICD	ICD
ICD	ICD
ICD	ICD

Results

- Icodextrin solution induces ultrafiltration through mechanisms of both crystallloid and colloid osmosis as presented in Figures 1 & 2.
- Small molecules of icodextrin (MW<1.08 kDa) act like crystallloid as showed in figure 3.
- A mathematical model also proves that changing the effective membrane pore sizes would alter the transport rate through the changes MW spectrum and osmotic reflection coefficient for each MW fraction through MWCO 3.5 & 30 kDa as showed in Figures 2 & 4.



Fig. 1. Mechanism of water transport induced by icodextrin. The crystallloid molecules are smaller than 1 nm (1.08 kDa) will diffuse freely out to the water side membrane will induce a flow of water towards the other side which has higher icodextrin concentration or lower water concentration. At the same time, icodextrin efflux out and out induces a flow of water by convective process.

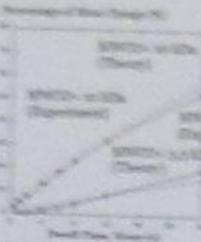


Fig. 2. The computer simulation theory models compare to the experimental results.



Fig. 3. HPLC analysis: Molecular weight distribution of small icodextrin molecules diffused outside the cellophane bags inducing the crystallloid effect.



Fig. 4. The computer simulation: Mass of the crystallized fraction (MW<1.08 kDa) in icodextrin solution using MWCO 3.5 kDa (left) and MWCO 30 kDa (right).

Discussions

- The Molecular weight cut-off of 10 kDa was chosen in order to mimic the endothelium with its small pores.
- The ability of solute to induce an osmotic flow is characterized by its osmotic reflection coefficient and the ratio between the solute size, and the spaces of the membrane¹.

Conclusions

- Besides colloid osmotic pressure, results from this study indicating that crystallloid-small-size solutes may play also a more prominent role in water transport.

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and the other two are not included in the present study.

Ph.D. University of Cambridge (Doctor of Philosophy)

第十一章 资本主义的“新保守派”

1. ធនាគារនិងបានការណ៍ដី និងបានការណ៍ទូរសព្ទ និង
2. ធនាគារនិងការណ៍បានការណ៍ទូរសព្ទ និងបានការណ៍ទូរសព្ទ

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- ก็ต้องการให้เป็นไปตามที่ต้องการ แต่เมื่อมาถึงจุดนี้แล้ว ก็ต้องยอมรับว่า ไม่สามารถจะดำเนินการต่อไปได้

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ຕະຫຼາມຕະຫຼາມ	20 ພົມສິດ	20 ພົມສິດ	ຕະຫຼາມ

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