

论著

胰蛋白酶对红细胞膜动态力学特性的影响

姚成灿¹; 姚平²; 黄耀熊^{3△}

暨南大学 1 药学院, 2 医学院, 3 生物医学工程研究所, 广东 广州 510632

收稿日期 2005-8-29 修回日期 2005-12-12 网络版发布日期 2008-8-14 接受日期 2005-12-12

摘要 目的: 研究胰蛋白酶对人红细胞膜表面电荷密度及动态力学特性的影响。方法: 用密度梯度离心法从健康成人血液中分离出“青年”和“老年”红细胞, 37 °C下与不同浓度的胰蛋白酶孵育60 min。利用Zeta电位分析仪测量红细胞膜表面电荷密度, 利用快速显微动态图像分析技术测定单个活态红细胞的大小、形态和细胞膜弯曲弹性模量(Kc)和剪切弹性模量(μc)。结果:

(1) 正常和用胰蛋白酶处理后“老年”红细胞的表面电荷密度分别显著小于正常和用胰蛋白酶处理后的“青年”红细胞(P<0.01)。(2) 正常“青年”红细胞和正常“老年”红细胞在形态上没有显著区别, 但正常“老年”红细胞的接触面积显著小于正常“青年”红细胞(P<0.01); 胰蛋白酶处理可减小红细胞的大小, 但对形状规范化因子没有显著影响。(3) 正常“老年”红细胞膜Kc和μc均显著大于正常“青年”红细胞(P<0.05); “青年”和“老年”红细胞膜Kc和μc均随胰蛋白酶浓度的增加而增大。结论: 胰蛋白酶处理可降低“青年”和“老年”红细胞膜表面电荷密度, 增加红细胞膜的弯曲弹性模量, 从而降低红细胞膜的力学变形性。

关键词 [红细胞膜](#); [弯曲弹性模量](#); [剪切弹性模量](#); [表面电荷密度](#); [胰蛋白酶](#)

分类号 [R363](#)

Influence of trypsin on the dynamic mechanical properties of intact RBC membrane

YAO Cheng-can¹, YAO Ping², HUANG Yao-xiong³

1College of Pharmacy, 2 Medical College, 3 Institute of Bioengineering, Jinan University, Guangzhou 510632, China

Abstract

AIM: To study the influence of trypsin on the membrane dynamic mechanical properties and the surface charge density of living intact red blood cell (RBC). METHODS: Young and old RBCs were separated from health adult human blood using the density gradient centrifugation. Then RBCs at different ages were incubated with trypsin at different concentration at 37 °C for 60 min. The surface negative charge density of RBCs was determined using ZetaPLUS potential analyzer. The size and membrane bending elastic modulus (Kc) and shear elastic modulus (μc) were determined by fast micro-image analyzing technology. RESULTS: (1) The surface negative charge density of normal and trypsin-treated old RBCs was significantly lower than those of normal and trypsin-treated young RBCs respectively (P<0.01). (2) The contact area of normal old RBCs was significantly smaller than that of normal young RBCs (P<0.05), but there was no difference in shape between normal young RBCs and normal old ones. Trypsin reduced the size of RBCs but did not affect the shape and size of both young and old RBCs. (3) The Kc and μc of normal old RBCs membrane were markedly larger than those of normal young RBCs respectively (P<0.05). The Kc and μc of young and old RBCs membrane were both increased at different concentration of trypsin. CONCLUSION: The surface negative charge density of young and old RBCs decreases, and the membrane elastic modulus of young and old RBCs membrane increases after treatment with trypsin. Therefore, the mechanical deformability of RBCs membrane is reduced.

Key words [Erythrocyte membrane](#) [Bending elastic modulus](#) [Shear elastic modulus](#) [Surface charge density](#) [Trypsin](#)

扩展功能

本文信息

- ▶ [Supporting info](#)
- ▶ [PDF\(675KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [参考文献](#)

服务与反馈

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [复制索引](#)
- ▶ [Email Alert](#)
- ▶ [文章反馈](#)
- ▶ [浏览反馈信息](#)

相关信息

- ▶ 本刊中 包含“[红细胞膜](#); [弯曲弹性模量](#); [剪切弹性模量](#); [表面电荷密度](#); [胰蛋白酶](#)”的 [相关文章](#)
- ▶ 本文作者相关文章

- [姚成灿](#)
- [姚平](#)
- [黄耀熊](#)

通讯作者 黄耀熊 tyxhuang@jnu.edu.cn