以雷射促進及控制 5-Fluorouracil 的經皮吸收

The Effect of Lasers on the Skin to Enhance and Control Transdermal Drug Delivery of 5-Fluorouracil

中文摘要

藥物經皮膚吸收具有方便、病人配合度高的優點。然而，此途徑需克服一些阻礙，其中，皮膚與生所具的角質層是經皮吸收藥物所的最重要障敝。雷射除可治療各種皮膚疾病外，它的物理性質以及其對皮膚產生的作用使它成爲一個很有潛力的經皮吸收促進方法。本篇研究利用體外穿透實驗探討三種不同雷射：鉺雅鉻雷射、紅寶石雷射及二氧化碳雷射對 5-Fluorouracil(5-FU)經皮吸收能力是否能有明顯的促進效果。光學顯微鏡下及電子顯微鏡下組織的變化亦加以比較，並討論其與促進穿透的相關性。由於此三種雷射性質及與組織之間的交互作用各不相同，使得三種雷射的組織學變化與對 5-FU 經皮吸收的促進效果各異。其中，Q-開關式紅寶石雷射(4.0 及 7.0 J/cm 2)對 5-FU 有中度的促進效果，同時對皮膚組織學的改變最小，雅鉻雷射對角質層(stratum corneum)有剝離(ablation)作用，對 5-FU 的促進效果最爲顯著。5-FU 在鉺-雅鉻雷射處理過的皮膚穿透速率(flux)爲正常皮膚的 53~133 倍。二氧化碳雷射皮膚除有剝離效應外，造成皮膚的熱損害亦明顯。低能量的二氧化碳雷射對 5-FU 穿透無影響，但在高能量(4.0 and 7.0 J/cm 2)時有 36 至 41 倍的促進效果。鉺-雅鉻雷射與二氧化碳雷射造成的皮膚組織改變在四天後大致都能完全恢復。

英文摘要

The effect of three lasers, i.e. the ruby, erbium:YAG, and CO2 laser, on the ability to enhance and control skin permeation of 5-fluorouracil (5-FU) was studied in vitro. Light microscopic and ultrastructural (scanning electron microscopic) changes in the nude mouse skin were also compared for these lasers. The histological observations and permeation profiles of each laser differed since the three lasers produce different physical and physiologic effects when striking the skin. The skin permeation of 5-FU could be moderately promoted by a single photomechanical wave generated by the ruby laser (at 4.0 and 7.0 J/cm2) without adversely affecting the viability or structure of the skin. The stratum corneum (SC) layer in the skin was partly ablated by a erbium:YAG laser, resulting in a greater enhancement effect on skin permeation of 5-FU. The flux of 5-FU across erbium:YAG laser-treated skin was 53?133-fold higher than that across intact skin. Both SC ablation and a thermal effect may contribute to the effect of the CO2 laser on skin structure. Lower energies of the CO2 laser did not modulate 5-FU permeation. A 36?41-fold increase in 5-FU flux was observed after

exposure to higher fluences (4.0 and 7.0 J/cm2) of the CO2 laser. Histological changes induced by both the erbium:YAG and CO2 lasers had completely recovered within 4 days.