Effect of praziquantel and albendazole on ultrastructure of protoscoleces of *Echinococcus granulosus*

XIAO Shu-Hua, SHEN Bing-Gui, YANG Yuan-Qing, YOU Ji-Qing, XU Dong-Hui
(Institute of Parasitic Diseases, Chinese Academy of Preventive Medicine, Shanghai 200022, China)
CHAI Jun-Jie, ZHANG Wen-Lin
(Xingjiang Institute for Endemic Disease Control and Research, Urumqi 830002, China)

Abstract: When protoscoleces of *Echinococcus granulosus*, maintained in 25% calf serum RPMI 1640 were exposed to praziquantel 1 μg/ml for 1-18 h, severe damages to the ultrastructure of protoscoleces were observed. The main lesions included indistinctness of the matrix, vacuolization and pitting, while vacuolization of perinuclear cytoplasma in tegumental cells, focus lysis in muscle bundles, and destruction in collection ducts and flame cells were also seen. The results suggest that the damages to the tegument, collection ducts and flame cells may interfere with the nutrition and defense functions of protoscoleces, and destroy the osmoregulatory system, which may be the major causes of death in protoscoleces during treatment with praziquantel. When protoscoleces were exposed to albendazole 20 μg/ml for 24-72 h, no apparent damage to the tegument was detected, except that some network-like structures appeared in the cytoplasma of tegumental and parenchyma cells.

Key words: *Echinococcus granulosus*; echinococcosis; protoscoleces; praziquantel; albendazole; electron microscopy

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1 WHO Collaborating Center for Malaria, Schistosomiasis and Filariasis.
对照组和原手术

根据文献描述，对对照组和原手术组进行了详细的比较。对照组在手术前进行了充分的准备，包括术前检查、药物准备和手术前的消毒工作。而原手术组在手术过程中出现了较多的并发症，包括出血、感染和术后疼痛等。

手术过程中，对照组和原手术组的表现也有所不同。对照组的手术时间较短，术中出血量较少，术后恢复较快。而原手术组的手术时间较长，术中出血量较多，术后恢复较慢。

总的来说，对照组在手术前的准备和手术过程中的表现都优于原手术组。这可能是因为对照组在术前准备和手术过程中采取了更科学、更严谨的方法。

未来的研究中，还需要进一步加强对术前准备和手术过程的优化，以提高手术质量和减少并发症的发生。
巨大空泡（Fig. 1），虫体后部的皮层部分无明显变化，仅剥去示例中局部罩膜覆盖，出现较大的不等或残余的空泡。这有一定差异（图2），甚至微粒，少数稀少，可皮层内视见较大的囊状空腔样结构，皮层细胞质的膜性的已破溃，或形成、借断、胞间借断和细胞质的多样性变化间或，形状间，细胞内的肠样空腔样变化，较多或仅留虚线（Fig II）。

48 小鼠于皮层体表，中或皮层脱落，皮层下纤维性肌束明显增宽（Fig 11, Plate 4）。其余皮层切片及外，基质明显磨耗，或出现不同类型的空泡，实质结也出现许多大小不等的空泡，合电子密度低的区域及囊状样结构（Fig 13），其余实变细胞，皮层细胞及细胞簇、集合管和细胞质的变化与24 h组的相似。

原尿分隔积体细胞瘤：20 g/ml 作用后的变化

小鼠血糖糖原分隔积小鼠体细胞瘤作用24 h后，其皮层、集合管、乳头区、间质细胞和肌束等均无明显改变，唯皮层细胞质核和胞质，有的呈发泡，有的局部分解小泡出现囊状结构（Fig 1K），培养48 h后，皮层细胞核聚集体的囊状结构扩展增多，出现类似似体。1b小时，大部分细胞的皮层仍有无明变化，少数皮层基质解聚出现囊状样结构，或微分水，皮下纤维性肌束，以及腺细胞间质聚集体，此外，除少数外，大部份皮层细胞核聚集体及实质细胞的囊状均出现类似较的囊状结构，有几未处整个制片（Fig lL），此外，少数的集合

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Discussion

血球对小鼠血糖糖原分隔积小鼠的囊状结构有明显的损害作用（1），我们观察的结果表明，血球引起的血糖糖原分隔积小鼠的囊状结构，同时
Fig 1. Protostrongylus ranaeformis exposed to praziquantel (PZQ) 1μg/ml or albendazol (ABZ) 20 μg/ml for 1-72 h in vitro, CD - collective duct, CM - circular muscle, FC - flame cell, FZ - fibrous zone, LM - longitudinal muscle, Ly - lysosome-like body, M - mitochondria, MS - myelin-like structure, N - nuclei, PC - parenchyma cell, PNC - perinuclear cytoplasm, PT - parenchyma tissue, S - spine, T - tegument, TC - tegument cell, V - vacuole. A) Control, showing tegument at anterior region (left) and posterior region (right), muscle and tegument cell (right). B) Control, showing collective duct (left) and flame cell (right). C) 1 h after exposure to PZQ, showing indistinction of collective duct accompanied by detachment of inner surface with disintegration of blob-like evagination. D) 2 h after exposure to PZQ, showing vacuoles with different kinds and sizes, collapse of damaged tegument, and appearance of myelin-like structure as well as lysosome-like body in parenchyma tissue. E) 3 h after exposure to PZQ, showing indistinction of matrix and disruption of large vacuole in tegument at anterior region, and swelling of nuclear membrane of tegument cell. F) 8 h after exposure to PZQ, showing indistinction of matrix of tegument at middle region with appearance of some large vacuoles. Increase of space of fibrous zone and focal lysis of some circular muscle bundles. G) 24 h after exposure to PZQ, showing extensive lysis and indistinct membrane-bound vesicles in a section through anterior region, partial lysis of muscles accompanied by formation of large vacuoles. H) 24 h after exposure to PZQ, showing swelling in sub tegument and parenchyma tissues, and degeneration of cell in flame cells. I) 48 h after exposure to PZQ, showing extensive peeling of tegument at anterior region, exposure of muscle with focus lysis. J) 48 h after exposure to PZQ, showing formation of numerous vacuoles with different sizes, and large myelin-like structure in parenchyma tissues. K) 72 h after exposure to ABZ, showing appearance of network-like structure in tegument cells. L) 72 h after exposure to ABZ, showing large residual vacuoles appeared in tegument at posterior region, swelling in sub tegument and parenchyma tissues, focus lysis of muscle bundles and numerous network-like structure appeared in cytoplasm of tegument cells. (See p 28/1)