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Disturbance of myocardial energy metabolism in the early stage following combined radiation-burn injury in rats

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Abstract The changes of cardiac mitochondrial oxidative phosphorylation and myosin ATPase activity and the effects of fluid therapy on the changes were observed in a period of 48 hours after a combined injury of 6 Gy radiation and 30% TBSA full chickness burns in rats. It was found that the capacity of cardiac mitochondrla oxidative phosphorylation and the activity of myosin ATPase were significantly decreased after 6 Gy radiation, 30% full thickness burns and a combination of the 2 and the decrease was more marked in the combined injury. There was a close correlation of the 2 parameters with the decrease of blood pressure. Fluid therapy greatly improved the myocardial energy metabolism. These findings suggest that ischemia and hypoxia are the main factors to result in disturbance of ebergy metabolism after combined radiation-burn injury.

Key words burns; ionizing radiation; mitochondrium; oxidative phosphrylation; ATPase; heart; rat

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拇腕掌关节形态结构与实验力学研究

The morphological and biomechanical research of trapeziometacarpal joint

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本项研究用人类学测量方法和结构光立体测量技术测量了拇腕掌关节面的形态,观察了关节面在不同运动方位时的咬合关系。用巨微解剖、组织切片和生物塑化技术观察了拇腕掌关节囊、韧带及关节软骨的形态、结构、动脉供应和微血管构筑,并用实验力学的方法测试了拇腕掌关节主要韧带和组成拇腕掌关节的第一掌骨的力学特性,探讨了拇腕掌关节形态及力学特性与关节稳定和运动的关系,主要研究结果如下:(1)大多角骨远侧端关节面的掌一背径(10.9±0.9 mm)比第一掌骨底关节面的掌一背径(11.5±1.2 mm)小,掌背曲率大于第一掌骨。但两关节面的表面积、关节面周长基本相等,说明两关节面形状相互适应,大小配合相当。按关节面的高度和曲率将拇腕掌关节面分为中央区、掌侧区、背侧区、尺侧区和桡侧区,关节面的中央区呈近似等曲率区。

(2)大多角骨远侧端和第一掌骨底关节软骨均以关节面中部较厚,边缘部较薄。关节面不同区域,关节软骨的组织结构也有差别。关节面的接触部位和接触面积,因活动方式不同而异,对掌运动时接触面积最大,其次是屈、伸和外展,内收时接触面积最小。

(3)拇腕掌关节囊背桡侧厚而紧张,掌侧和尺侧薄而松弛,拇长展肌腱分成2~3束止在关节囊桡侧附着部,掌侧有拇短屈肌腱保护;拇腕掌关节的韧带以背桡侧韧带交强状。供应拇腕掌关节的动脉主要来自桡动脉主干,桡动脉掌浅支,第一掌背动脉和拇主要动脉;供应关节囊的动脉有多个来源,动脉支在关节囊表面吻合成第一层动脉网,然后分支进入关节囊纤维层和韧带内,并形成"绳梯状"血管网;分布关节囊滑膜层的血管形成与滑膜腔面平行的多层血管网,网的末端是毛细血管襻。供应骨关节面区域的动脉来自滋养动脉和骨膜动脉,在骨内形成树枝样血管网,血管网发弓状毛细血管襻伸至关节软骨下方。

(4)第一掌骨应力一应变关系呈线性关系,说明第一掌骨是基本符合 HooK 定律的弹性材料,其本构方程是:$\sigma = 2859.03\varepsilon - 0.3665$,杨氏弹性模量是:2517.51±576.78 MPa,破坏扭转强度是33.38±6.93 MPa,最大扭角平均13.2±1.2度,扭角一应变关系和扭角一扭矩关系均呈指数函数关系,剪切弹性模量(737.78±249.70 MPa)小于其压缩弹性模量。

(5)拇腕掌关节前斜韧带和背桡侧韧带的应力一应变关系呈幂函数关系:背桡侧韧带的杨氏弹性模量:2.6501±0.6838 MPa,前斜韧带的杨氏弹性模量:1.0904±0.3689 MPa;背桡侧韧带的抗张强度(13.42±1.76 N/mm^2)大于前斜韧带的抗张强度(6.23±0.97 N/mm^2)。两韧带均主要由胶原纤维束组成,韧带受力前,纤维束呈波纹状外观,当张力负荷达到韧带抗张强度10%时,纤维束的波纹状外观基本消失,负荷达抗张强度的70%时,纤维束开始断裂,张力负荷达抗张强度时,纤维束完全断裂。

关键词 拇腕掌关节;关节面;韧带;形态学;生物力学

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