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Effect of physical exercise on arterial thrombosis formation

Cristina Pontes Vicente (PQ), Maria Júlia Marques (PQ), Denise Gonçalves Pedrosa (PG), Micheli Severo Sielski (PG), Maiara Ferreira Terra (IC)

Abstract

Vascular injury and subsequent thrombosis are key events on artery diseases. One of the most common way to prevent cardiovascular diseases is physical exercise, mostly aerobic, that acts reducing blood pressure by promoting vasodilatation and improving blood circulation. The aim of this study is analyze the influence of physical exercise on arterial thrombosis formation (project approved by Ethics Committee of UNICAMP, protocol nº 3550-1). Mice C57Bl/6 of 8 weeks were exercised during 21 days on treadmill at 12m/min and arterial lesion was indices by ferric chloride ($FeCl_3$) 15%, positioned on right carotid artery. The chemical compound accomplishes a chemical oxidation promoting adhesion and platelet aggregation, which activates coagulation cascade and interrupt local blood flow. The histological analysis was made using hematoxylin-eosin (HE) staining.

Key words: Physical exercise, training, thrombosis.

Introduction

Thrombus formation in coronary and cerebral arteries is the principal cause of mortality among cardiovascular diseases. Animals models of thrombosis are being used to mimic human diseases and as an aid in discovery of new drugs. Chemical induced thrombosis has been widely used and it promotes a local oxidation, resulting in platelet adherence and aggregation on the local lesion by activating coagulation cascade[1]. Previous studies demonstrate that regular physical exercise is associated with a decrease on the risk of cardiovascular disease, which improves endothelial function, blood pressure, insulin sensitivity and inflammatory variables, besides reducing vascular oxidative stress[2].

Results and Discussion

All animals were divided in: control; exercised for 21 days; injured + 3 days; and exercised, injured + 3 days (Figure 1). Animals were exercised on treadmill 21 days before surgery, 5 days per week at 12m/min. Arterial injury was made in the right carotid with a paper (1mm²) impregnated with ferric chloride 15%, blood flow was measured using an ultrasound probe and animals were sacrificed 3 days after injury. The area of thrombus formation was determined with ImageJ 1.42q software by subtraction of lumen area from the total area encompassed by the internal elastic lamina (Figure 2). The medial area was calculated by subtraction of the area encompassed by internal from external elastic lamina. We found a 50% reduction of thrombus formation in exercised animals ($p \leq 0,05$). This result demonstrates that regular physical activity may attenuate thrombosis in mice.

Figura 1. Carotid arteries of control (A), injured + 3 days (B), exercised for 21 days (C) and exercised, injured + 3 days (D). Histological analysis with HE.

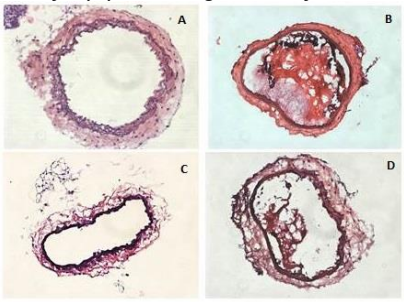
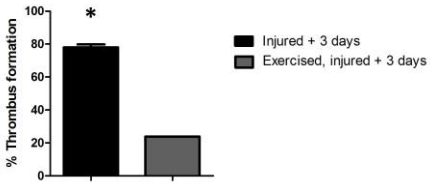


Figure 2. Area of thrombus formation in the lumen.



Conclusions

In conclusion, our study demonstrates that physical exercise exerts favorable effect on the vascular response and reduces the area of thrombus formation in C56Bl/6 mice.

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[1] Wang, X. and L. Xu, *An optimized murine model of ferric chloride-induced arterial thrombosis for thrombosis research.* Thrombosis Research, 2005. **115**(1): p. 95-100.

[2] Laufs, U., *et al. Physical training increases endothelial progenitor cells, inhibits neointima formation, and enhances angiogenesis.* Basic Science Reports, 2004. **109**: p. 220-226.