Comparison of the Anticoagulant Activity of Porcine and Bovine Heparin Fractions with Different Molecular Weight

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INTRODUCTION: Despite its widespread use, heparin has limitations due to its anticoagulant unpredictable effects, causing high risk of bleeding. Safer alternatives are the low-molecular-weight heparins (LMWH), obtained by fractionation or fragmentation of unfractionated heparin (UFH). UFH are isolated from porcine intestines or bovine lungs, whereas LMWH are obtained only from porcine UFH. Reported herein is a comparison between anticoagulant and antithrombotic effects of high-molecular-weight (HMWH) and low-molecular-weight (LMWH) heparins obtained by fractionation of porcine and bovine UFH. MATERIAL AND METHODS: Porcine and bovine UFH were fractionated by ultrafiltration at 10 kDa cut-off membranes. Anticoagulant activity of heparins was evaluated by the clotting assay of APTT. The effects on inhibition of α-thrombin and factor Xa were also evaluated. RESULTS AND DISCUSSION: Ultrafiltration of UFH gave rise to two fractions of each heparin (porcine and bovine), yielding about 70% of HMWH and 30% of LMWH. Porcine heparins (UFH, HMWH, and LMWH) showed activity of 171.8 UI/mg, 175.7 UI/mg, and 134.6 UI/mg, respectively, while bovine heparins (UFH, HMWH, and LMWH) had activity of 142.3 UI/mg, 154.7 UI/mg, and 103.9 UI/mg, respectively. All three porcine heparin fractions showed similar activity on inhibition of α-thrombin in the presence of antithrombin. On the other hand, regarding bovine heparins, fraction HMWH showed two times more activity than UFH. When using heparin cofactor II, the inhibitory effect of porcine and bovine heparins were similar to all fractions. For factor Xa in the presence of antithrombin, the fractions of porcine heparins were more potent than the correspondent fractions of bovine heparins. Moreover, both porcine and bovine HMWH were more potent than UFH and LMWH. CONCLUSION: Ultrafiltration gives rise to heparin fractions with different anticoagulant activity, and different potency on inhibition of α-thrombin and factor Xa in presence of antithrombin.

Keywords: porcine heparin, bovine heparin, anticoagulant activity

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