Bovine and porcine heparins differ in their structure, anticoagulant activity and neutralization curves with protamine

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Introduction: Heparin is used for the treatment of thromboembolic diseases and is also required for extracorporeal circulation during cardiovascular surgery and dialysis session. Neutralization of heparin at the end of extracorporeal circulation requires proper doses of protamine to avoid bleeding. The structure and anticoagulant activity of heparins obtained from different sources vary considerably. These differences may affect their neutralization curves with protamine. Material and Methods: The structure, anticoagulant activity and neutralization curves of heparin with protamine were determined using standard procedures recommended by most pharmacopeias. Results and discussion: Heparins from different sources differ considerably in their structure and anticoagulant activity. Thus, heparin from bovine lung has a uniform disaccharide unit, composed of trisulfated disaccharides. Heparins from porcine intestine and especially from bovine intestine have more heterogeneous structures. Their anticoagulant activity also varies significantly. Heparins from bovine intestine and lung have lower anticoagulant activities (50% and 60%, respectively) when compared to heparin from porcine origin. Neutralization by protamine was determined using heparins solutions prepared on a weight basis and on an IU basis. To achieve neutralization, significantly higher doses of protamine are required for bovine heparins than for porcine heparin, on an IU basis. This result is important because in clinical practice, protamine is administered based on its anticoagulant activity (IU/mL) and not on weight concentration (mg/mL). Conclusions: Our results demonstrated that bovine and porcine heparins differ significantly in their structure, anticoagulant activity and in the doses for protamine required for neutralization of their activities. These heparin pharmaceutical preparations are not equivalent drugs.

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