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The effects of intra-arterial and intraportal injections of histamine on the simultaneously-perfused hepatic arterial and portal venous vascular beds of the dog

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Histamine injected into the hepatic artery of the dog causes dose-dependent hepatic arterial vasodilatation, whilst injections of histamine into the hepatic portal vein elicit dose-dependent portal vasoconstriction; both effects are mediated primarily through histamine H_1-receptors (Richardson & Withrington, 1976, 1977). We have now examined the effects of intra-arterial and intraportal injections of histamine on the sympathetically-innervated hepatic arterial and portal venous vascular beds where both were perfused simultaneously, using a combination of techniques previously reported for the separate perfusion of the two circuits: control values were similar to those in previous publications (Richardson & Withrington, 1976, 1977).

Intra-arterial injections of histamine (0.1–50 μg) elicited dose-dependent hepatic arterial vasodilatation with a maximum reduction in hepatic arterial vascular resistance (HAVR) of 44.2 ± 4.3% (mean ± s.e. mean; $n = 8$). These injections also produced dose-dependent increases in hepatic portal vascular resistance (HPVR) of up to 161.6 ± 54.5% on injection of histamine (50 μg) into the hepatic artery. The delay between the injection and onset of the hepatic arterial response to a selected dose (10 μg) of histamine (2.4 ± 0.3 s) was significantly shorter than that to the increases in HPVR (7.7 ± 1.2 s; $P < 0.01$). However, both hepatic vascular effects significantly preceded reductions of 5.0 ± 1.2 mm Hg in systemic arterial pressure (BP) resulting from histamine entering the systemic circulation (15.6 ± 1.2 s; $P < 0.005$).

Intraportal injections of histamine (0.1–100 μg) caused dose-dependent increases in HPVR (maximum = 220.5 ± 75.7%) and in addition, dose-dependent hepatic arterial vasodilatation (maximum reduction in HAVR = 37.8 ± 4.1%, $n = 8$). On intraportal injection of histamine (10 μg), the hepatic arterial response had a significantly shorter latency than the increase in HPVR (7.2 ± 0.8 s and 11.44 ± 1.3 s respectively; $P < 0.005$), and both liver vascular effects significantly preceded the onset of reductions of 6.6 ± 1.2 mm Hg in BP at 14.6 ± 1.2 s ($P < 0.02$). The lowest doses of intraportal histamine (0.1–1.0 μg) caused negligible changes in HPVR, no systemic effects, but increases in hepatic arterial blood flow of up to 15%.

The time courses of the responses to intra-arterial and intraportal histamine compared with those of the reductions in BP suggested that the effects on the two liver circuits could not be attributed to recirculation. This was further examined by injecting histamine (10 μg) into the inferior vena cava at the level of the hepatic veins: reductions of 19.5 ± 4.5 mm Hg in BP occurred 4.5 ± 1.0 s after injection, followed significantly later ($P < 0.001$) by the hepatic arterial (18.9 ± 0.9 s) and portal (16.0 ± 1.1 s) responses.

These experiments illustrate that when histamine is released into the portal bloodstream from the gastrointestinal tract in shock or anaphylaxis (Kahlson & Rosengren, 1971), it may cause increases in hepatic arterial blood flow even though vasoactive concentrations of histamine are not attained in the systemic circulation.

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