EFFECT OF GANGLION BLOCKING ON THE HEPATIC CIRCULATION

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Chronic experiments on 16 cats using motion-picture angioradiography showed that moderate ganglion blocking is followed by a considerable (up to 180%) increase in the arterial volume blood flow. The portal blood flow increases or decreases depending on the level of arterial hypotension. A fall of the systemic arterial pressure leads to a proportional increase in the contribution of the arterial blood flow to the total hepatic volume blood flow. The linear blood flow is slowed. Ether anesthesia causes a sharp decrease in the portal volume blood flow and an increase in the arterial flow. Moderate ganglion blocking against this background causes a further increase in the arterial and partial restoration of the portal blood flow.

The risk of serious disturbances of the hepatic circulation under the influence of intensive ganglion blocking with severe arterial hypotension is not disputed [4, 9, 10]. Yet few investigations have been carried out to study changes in the hepatic hemodynamics after moderate ganglion blocking, and even then only the total hepatic volume blood flow was determined [7].

In this investigation changes in the blood flow were studied in the systems of both main vessels of the liver (the hepatic artery and portal vein) under the influence of moderate ganglion blocking; this is a matter of considerable importance when considering the value or potential hazard of such a block.

EXPERIMENTAL METHOD

Experiments were carried out on cats weighing 3-4 kg. The various parameters of the hepatic circulation were studied by contrast motion-picture angioradiography [5]. The contrast material (2-3 ml 50% urotrast) was injected alternately into the aorta and the portal vein. The radiographic investigations were carried out three times: on unanesthetized animals (initial data) and twice after injection of azamethonium bromide in a dose of 3-5 mg/kg, when the arterial pressure levels were 100-115 and 70-80 mm (six animals – series I).

In the experiments of series II (six animals) the investigations were carried out initially on intact cats, then on cats anesthetized with ether [3, 6] and again after injection of azamethonium bromide into the animals anesthetized with ether. In a control series of experiments (four cats) the arterial and portal blood flow was investigated three times in the course of 2-2.5 h.

To calculate the volume velocities of the blood flow the equation recommended by Seleznev et al. [5] was used. The linear velocity of the blood flow (in mm/sec) was determined as the ratio between the length of a segment of a blood vessel (through which the contrast material passed in time t) and the time t calculated from the number of frames.

EXPERIMENTAL RESULTS

Moderate ganglion blocking accompanied by lowering of the arterial pressure to not below 95 mm (on the average from 135 ± 4.7 to 108 ± 6.5 mm) led to a very slight but significant ($P < 0.05$) slowing of the

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TABLE 1. Principal Indices of Hepatic Circulation in Cats after Ganglion Block (M ± m)

Series	Stage of investigation	Arterial pressure, in mm Hg	Velocity of blood flow in portal vein		Velocity of blood flow in hepatic artery		Total volume blood flow through liver (in ml/min/100 g)	Contribution of arterial blood flow (in %)
			linear (in mm/sec)	volume (in ml/min/100 g)	linear (in mm/sec)	volume (in ml/min/100 g)		
I (n=6)	Initial data	135±4,7	87,5±7,8	36,1±1,7	185,2±17,3	8,1±0,4	44,1±1,9	18,3±0,6
	Ganglion block:							
	with moderate arterial hypotension	108±6,5	79,2±6,1	42,8±0,8	167,5±13,2	14,6±1,2	57,4±1,6	25,5±1,2
	with more marked hypotension	74±3,4	67,0±4,4	32,3±2,6	140,2±12,0	14,6±0,8	46,9±3,5	31,2±0,8
II (n=6)	Initial data	117±3,8	87,9±12,6	37,6±4,0	182,0±12,0	8,7±0,6	46,2±4,5	18,9±0,7
	Ether anesthesia	112±2,9	90,3±9,5	13,4±1,0	179,0±19,4	13,8±1,1	27,2±1,7	55,6±3,6
	Ganglion block + ether anesthesia	89,5±9,4	82,0±8,7	24,1±4,4	153,0±17,8	15,9±1,2	39,9±5,3	41,5±3,6

linear velocity of the blood flow along both main vessels supplying blood to the liver (Table 1). The total volume blood flow through the liver was thereby increased by 30% ($P < 0.001$) on account of an increase in the volume blood flow along both the portal vein and the hepatic artery; the blood flow along the hepatic artery, however, showed a greater increase (by 80%) compared with the initial values ($P < 0.001$). These changes were reflected in the ratio between the arterial and portal fractions of the total hepatic blood flow; the contribution of the arterial blood flow was increased by more than one-third.

With more marked arterial hypotension (74 ± 3.4 mm) there was a further significant slowing of the linear blood flow. The portal volume blood flow was reduced ($P < 0.05$) whereas the volume blood flow along the hepatic artery remained high (180% of the initial value). These changes led to a considerable increase in the arterial fraction of the total blood flow through the liver.

Analysis of the results showed that lowering of the systemic arterial pressure is invariably accompanied by an increase in the contribution of the arterial blood flow to the total blood flow through the liver (coefficient of correlation between these two indices $r = 0.8 \pm 0.1$).

These results cast doubt on the view, widely held in the literature, that gangliolytics increase the volume blood flow along the system of the portal vein only, so that a large volume of poorly oxygenated blood enters the liver [2, 4, 8].

The known ability of ether anesthesia to reduce the volume blood flow through the liver as a result of vasoconstriction in the hepatoportal region [1] provided an opportunity for the use of gangliolytics in order to correct these disturbances.

Ether anesthesia by itself was accompanied by a considerable (41%) decrease in the total volume blood flow through the liver on account of a sharp decrease in the portal blood flow (Table 1). The volume velocity of the arterial blood flow increased by 59% ($P < 0.001$). These changes led to a considerable increase in the arterial fraction of the total hepatic blood flow (up to 55.6 ± 3.6%). Changes in the linear velocity of the blood flow were not significant.

Ganglion blocking against this background led to partial restoration of the total blood flow through the liver (up to 86.5% initial values), as a result not only of an increase in the portal blood flow but also of a further increase in the arterial blood flow. The contribution of the latter to the total blood flow through the liver was slightly reduced ($P < 0.05$), but it still remained twice as high as initially. The linear velocity of the blood flow fell slightly along both main vessels supplying blood to the liver ($P < 0.05$).

Changes in the principal indices of the hepatic circulation in the control group of experiments were not significant.

Moderate ganglion blocking thus successfully corrected the disturbances of the hepatic circulation caused by ether anesthesia.

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