Abnormal Hindquarter Vasoconstrictor Tone, a Feature Common to Various Kinds of Hypertensive Rats

Juro IRIUCHIJIMA

Department of Physiology, School of Medicine, University of Hiroshima, Hiroshima, 734 Japan

Summary Hindquarter peripheral resistance, calculated as arterial pressure divided by hindquarter blood flow, decreased significantly on ganglionic blockade with hexamethonium bromide in four kinds of experimentally hypertensive rats, i.e. spontaneously hypertensive rats (SHR), DOCA-salt hypertensive rats, and one-kidney, one-clip and two-kidney, one-clip renovascular hypertensive rats, but not in normotensive control rats in the conscious state. Abnormal hindquarter vasoconstrictor tone seems to be a feature common to various kinds of hypertensive rats.

Key words: rat hypertension, vasomotor tone.

Previously we observed that the hindquarter (terminal aortic) blood flow decreased when the arterial pressure fell on ganglionic blockade in normal rats (IRIUCHIJIMA and SAKATA, 1985) but not in spontaneously hypertensive rats (SHR, OKAMOTO and AOKI, 1963) (IRIUCHIJIMA, 1986) and DOCA-salt hypertensive rats (DOC) (SHIMAMOTO and IRIUCHIJIMA, 1987). We interpreted these findings as suggesting that SHR and DOC had an abnormal vasoconstrictor tone in resistance vessels of the hindquarters. At that time we were recording hindquarter flow and arterial pressure in separate rat groups. An electromagnetic flow probe was implanted around the terminal aorta for hindquarter flow. An indwelling catheter was inserted into the terminal aorta via a femoral artery for arterial pressure.

We repeated the above experiment with the arterial catheter inserted into the right common carotid artery in the same rat with the flow probe at the terminal aorta. This method enables one to observe hindquarter flow and arterial pressure in the same rat and to follow successive changes of hindquarter peripheral resistance calculated as arterial pressure divided by hindquarter flow. The technical details of implantation of an electromagnetic flow probe at the terminal aorta have been described previously (KAWAUE and IRIUCHIJIMA, 1984). The right common carotid artery was tied immediately caudally to the bifurcation and a PE10 tube was

Received for publication March 19, 1988
inserted toward the aorta for about 26 mm. A venous catheter for injection of drugs was inserted into the external jugular vein. Observations of flow and pressure in the conscious state in the rat remaining in the home cage were performed 3–5 days after the implantation.

All rats employed in the present study were male and 10–20 weeks old at the time of the flow and pressure measurements. SHR were descendants from those donated from the Shimane Medical School, weighing 250–300 g. Other rats were Wistar rats from the Hoshino Animal Farm, weighing 250–450 g. Normotensive control rats (NCR) were intact before implantation. DOC were prepared by injecting deoxycorticosterone acetate subcutaneously at a dose of 30 mg/kg once a week and giving 1% saline as the drinking fluid for 2–3 weeks after removing the right kidney. Two types of renovascular hypertensive rats were also investigated. A metal clip with a gap of 0.3 mm was applied at the left renal artery. The right kidney

Fig. 1. Comparison of the effects of intravenous infusion of hexamethonium bromide (C6, for underline periods to a total dose of 25 mg/kg) on arterial pressure (AP) and hindquarter (terminal aortic) flow (HQF) between a normotensive control rat (top pair) and a spontaneously hypertensive rat (bottom pair). In the normal rat, both hindquarter flow and arterial pressure decreased markedly with hindquarter resistance almost unchanged. In the hypertensive rat, the decrease in flow was slight, if present at all, in the face of the marked decrease in arterial pressure, indicating a decrease in hindquarter resistance.
was either removed (one-kidney, one-clip renovascular hypertensive rats, 1K1C) or left intact (two-kidney, one-clip renovascular hypertensive rats, 2K1C). The implantation of the flow probe and arterial catheter was performed 2–3 weeks after the clipping.

One example each of recording of arterial pressure and hindquarter flow before, during, and after infusion of hexamethonium bromide for ganglionic blockade in NCR and SHR is presented in Fig. 1. On the recording paper the mean arterial pressure and hindquarter flow while the rat was apparently at rest were read immediately before and after intravenous infusion of a 2.5% solution of hexamethonium bromide at a dose of 25 mg/kg, at a rate of 0.8 mg/min. The percent change of hindquarter resistance of ganglionic blockade was calculated. The mean and S.D. of the change for each group of rats is graphically presented in Fig. 2. Hindquarter resistance decreased significantly in all the four kinds of hypertensive rats examined but not in NCR.

Assuming that the decrease in blood flow resistance on ganglionic blockade indicates the presence of sizable sympathetic vasoconstrictor tone in the regional resistance vessels, we can conclude that the presence of abnormal vasoconstrictor tone in the hindquarters is a marked feature common to all kinds of experimentally hypertensive rats so far examined.
REFERENCES


