This would mean that the contribution of the renin-angiotensin system is negligible for the respiratory changes observed during the bladder distension.

Humoral substances like prostaglandins are known to increase the ventilation. GILMORE and VANE (1971) reported release of prostaglandin like substance during bladder distension. It is likely that apart from neural factors humoral substances like prostaglandins might also be contributing to the increased ventilation during the bladder distension. Here a wide field is open and further studies are necessary to investigate these mechanisms.

5. SUMMARY

In the present study the cardiovascular and the respiratory changes during the distension of the urinary bladder for 2 - 3 min were studied in anaesthetized dogs and cats. Electrical stimulation of the pelvic and the hypogastric nerves were performed with the aim of finding out their relative contribution in the observed responses. Factors such as intraabdominal pressure, ureteral pressure and sino-aortic nerves influencing these parameters were also studied. The effect of long term distension of the bladder (30 - 120 min) was also investigated. The role of the renin-angiotensin system in the observed responses was studied.

The results of this study are as follows:

1. Pneumatic distension of the urinary bladder in dogs resulted in an increase of the arterial pressure, the heart frequency and the respiratory frequency.

2. An increase in the mean arterial pressure was also seen with distension of the bladder by urethral infusion of saline at a rate of 40 - 45 $ml \cdot min^{-1}$ in dogs. The minimum intravesical pressure to which the arterial pressure responded by an

increase was 41.1 ± 3.9 Torr.

3. Also in anaesthetized cats, urethral infusion of saline at a rate of 80 $ml \cdot min^{-1}$ resulted in an increase of the systolic and the diastolic pressures. The magnitudes of the increases of the systolic and the diastolic pressures were the same. The minimum intravesical pressure at which the arterial pressure responded with an increase was 58.1 ± 1.3 Torr. After the maximum increase, the arterial pressure showed adaptation. There was a slight bradycardia in the initial 60 s of bladder distension. Sometimes extrasystoles were also seen. Tidal volume, respiratory frequency and the minute ventilation were increased during the bladder distension.

4. The increase of the arterial pressure, heart frequency and the respiratory changes were approximately the same with bladder distension in situ as compared with the exteriorized bladder distension.

5. Peripheral venous pressure below the bladder was markedly increased during the distension of the bladder in situ, whereas such an increase was totally absent during exteriorized distension.

6. During the long term distension of the bladder in situ for 30 min the systolic and the diastolic pressures initially increased. At 30 min of bladder distension they had almost returned to the predistension values, though the intravesical pressure was still elevated to a level of 71.4 ± 3.8 Torr. In the same cats during the distension of the exteriorized bladder though the arterial pressure had decreased at 30 min of distension the decrease was not as much pronounced as it was during the distension in situ. Similarly in dogs distending the bladder for a period of 2 hours resulted in a hypotension whereas with exteriorized distension there was an increase of the arterial pressure.

7. During the long term distension of the bladder in dogs the peripheral venous pressure distal of the bladder increased, while proximal of it decreased.

8. The heart responded with a bradycardia to bladder distension in situ for 30 min while such a bradycardia was less apparent in exteriorized distension of the bladder.

9. The increase in the minute ventilation relatively more with long lasting distension of the bladder in situ than during long lasting distension of the exteriorized bladder.

10. If the ureters of the animals were cannulated after 90 s of bladder distension the increases of the systolic and the diastolic pressures were considerably less as compared with the responses of the animals with intact ureters. Heart frequency and the respiratory responses were not affected by cannulating the ureters.

11. In sino-aortic denervated cats distension of the urinary bladder resulted in a more pronounced increase of the arterial pressure than in non-denervated controls. There was a slight tachycardia during the distension. Respiratory responses were diminished in the sino-aortic denervated group as compared with intact sino-aortic nerves.

12. Electrical stimulation of the hypogastric nerve always resulted in a higher increase of the systolic and diastolic pressures as compared with stimulation of the pelvic nerve, with identical stimulus parameters, with intact sino-aortic nerves as well as after buffer denervation.

13. Electrical stimulation of the afferents from the bladder caused an initial tachycardia followed by a bradycardia. These heart frequency responses were unaltered after buffer denervation.

14. With intact buffer nerves pelvic nerve stimulation caused a higher increase of ventilation than hypogastric neve stimulation. After sino-aortic denervation hypogastric nerve stimulation also resulted in a marked increase of the ventilation.

15. After bilateral renal denervation the increase of the systolic

pressure during electrical stimulation of the hypogastric nerve was decreased, while such a decrease was not seen during pelvic nerve stimulation. During the stimulation of the hypogastric nerve, efferent renal nerve activity was increased before any change in the arterial pressure and such an increase in the renal nerve activity was not seen during pelvic nerve stimulation. Ventilatory changes were not affected by renal denervation.

16. After bilateral renal denervation and also after clamping the renal vessels the increases of the systolic and diastolic pressures were decreased in the period after 90 s of bladder distension. Heart frequency and respiratory changes were not appreciably altered.

17. After the infusion of either one of the angiotensin II antagonists (1Sar-8-Leu AT II;1-Sar-8-Ala-AT II) the systolic and the diastolic pressures were below those in the controls in the period after 60 s of bladder distension. A similar reduction in the pressor response was also seen with the electrical stimulation of the hypogastric and the pelvic nerves.

18. After the administration of the angiotensin II antagonist the respiratory frequency in the predistension period increased but the ventilatory changes observed with bladder distension and stimulation of the afferents from the bladder were not affected by the angiotensin II antagonist.

19. Bilateral adrenalectomy did not alter neither the pressor response nor the ventilatory changes observed during bladder distension.

From these results the following conclusions were drawn:

1) Bladder distension with intact nervous system results in an increase of the arterial pressure in cats as well as in dogs.

2) The hypogastric nerve seems to be the primary sensory nerve for mediating the cardiovascular changes.

3) Sino-aortic nerves exert a tonic inhibitory influence on the pressor responses during the bladder distension.

4) Apart from the neural factors mechanical factors like the increased abdominal pressure and ureteral pressure also contribute to the haemodynamic alterations during the bladder distension.

5) The renin-angiotensin system appears to play an important role in the arterial pressure increases during the bladder distension.

6) Bladder distension results in an increase of the minute ventilation. Neural as well as humoral factors may contribute to the mechanism of this increase.