9. Studies on Sinocaval Conduction[†]

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Few reports are available on the electrical activities of the vena cava muscle proximal to the heart. The previous papers¹⁾²⁾³⁾ from this laboratory have demonstrated that the impulse which originates in the sinus node spreads not only to the atrial muscle but also to the vascular muscle in venae cavae (sinocaval conduction). The present paper deals with the problem of induction of fibrillation in the left superior vena cava by aconitine.

METHODS

The experimental methods were the same as described elsewhere²⁾³⁾. Under artificial respiration after intraperitoneal injection of pentobarbital sodium, the rabbit was thoracotomized. The three venae cavae (vena cava superior dextra, vena cava superior sinistra and vena cava inferior), being cut at 2–3 cm from each cardiac ostium, the heart was excised and a large part of both ventricles were resected. This atriocaval preparation was fixed in a chamber irrigated with oxygenated TYRODE solution at 37°C. The transmembrane potentials were recorded from the outer surface of the right atrium and left superior vena cava. For inducing the fibrillation a 0.1% solution of aconitine was instilled in the chamber after stopping the flow of perfusate to make the final concentration of 10^{-6} g/ml.

RESULTS

The records shown in Fig. 1 show the effects of aconitine on the electrical activities in the vena caval muscle. A single fiber in the sinus node (SN) and that in the left superior vena cava at 10 mm from the ostium (S 10) were impaled simultaneously by two microelectrodes. The control record shows that the left superior vena cava was activated regularly under sinus rhythm (A). The application of aconitine produced firstly the sinus tachycardia (B), and then gradually the electrical activities in the sinus node and vena cava became irregular until the typical fibrillation developed

Fig. 1. Aconitine-induced fibrillation in left superior vena cava proximal to the heart.

(C, D). During typical fibrillation irregular appearance of action potentials of various sizes was noted and no synchronism was observable in electrical activities between sinus node and vena cava.

Fig. 2 shows the induction of fibrillation in isolated strip of left superior vena cava. The strip was electrically driven at 1.5 cycle per

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Fig. 2. Induction of fibrillation in isolated strip of left superior vena cava.

second (A). A few minutes after the application of the drug, the spontaneous firing appeared intermittently and it became more and more frequent (B, C). Then the electrical stimulation was stopped. The isolated strip continued the spontaneous tachycardia (D) and finally the typical fibrillation developed (E).

DISCUSSION

Aconitine has been known as a characteristic

substance which induces a flutter or fibrillation in the cardiac muscle⁴⁾⁵⁾. However, studies on the effects of aconitine on the transmembrane potentials of vascular muscle have never been performed. The present results show that aconitine induces the automaticity and the fibrillatory activity not only in the cardiac muscle but also in the vena caval muscle. The ectopic pace-maker formation in the vena caval muscle may present the interesting problems for considering the mechanisms responsible for the cardiac arrhythmias.

SUMMARY

Aconitine induces the automaticity and fibrillatory activity in the vena caval muscle. The electrical activities in the vena caval muscle may have physiological significance.

REFERENCES

- 1) Mashiba, H., Yanaga, T. and Ito, M., Studies on transmembrane action potential of mammalian vascular smooth muscle and myo-myoeccitation transmission between cardiac and vascular muscle. *Kyushu J. Med. Sci.* **14**: 121-130, 1963.
- 2) Ito, M., Yanaga, T. and Mashiba, H., Studies on transmembrane potential and sinocaval conduction in mammalian cardiac and vascular smooth muscle (first report). *Kyushu J. Med. Sci.* **14**: 393-402, 1963.
- 3) Ito, M., Yanaga, T., Saeki, K., Arita, M., Ishihara, M. and Mashiba, H., Studies on sinocaval conduction of the rabbit with microelectrodes. *Jap. J. of Physiol.* **14**: 439-449, 1964.
- 4) Yanaga, T., Studies on aconitine-induced atrial fibrillation of the young rabbit by the microelectrode technique. *Jap. Circul. J.* **25**: 1284-1304, 1961. (in Japanese).
- 5) Goto, M., Tamai, T. and Yanaga, T., Studies on the appearance and termination of aconitine-induced atrial fibrillation with microelectrodes. *Jap. J. of Physiol.* **13**: 196-207, 1963.