THE BLOOD-PRESSURE REFLEXES OF THE RABBIT UNDER URETHANE ANÆSTHESIA.

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Urethane is an anæsthetic very frequently used either alone or in combination with other drugs for work on rabbits. The following observations were made in the course of some investigations upon the cerebral circulation, with special reference to the reflex from the carotid sinus extensively described by H. E. Hering(1).

Briefly, according to this author, this reflex is concerned with the regulation of the general blood-pressure level and is subserved by a distinct nerve—the sinus nerve. Stimulation of the sinus region or of the nerve results in a fall of blood-pressure.

Hering, in his monograph, gives many tracings from rabbits, anæsthetised, at least partially, with urethane. It is the purpose of this communication to point out that the effects of this anæsthetic complicate any conclusions drawn from experiments on blood-pressure reflexes in the rabbit.

We are indebted to Sir Charles Sherrington for pointing out to us that depressor reflexes in the rabbit can be obtained from numerous procedures after the administration of large doses of chloral. This fact directed our attention to the urethane.

Intravenous urethane was found to be an excellent anæsthetic for rabbits when recovery, after operation, was desired. For this purpose ·75 grm. per kilo of 25 p.c. solution was slowly injected into an ear vein after which anæsthesia occurred very rapidly. For operative procedures the urethane was supplemented by ether. Recovery was complete from this dose in about 12 hours and without any obvious after effects.

For the acute experiments on reactions obtained from the carotid sinus, the urethane was administered in the same way and in the same or slightly larger dosage[1]. For the operative procedures ether was also

[1] Urethane has been found to have the same action on blood-pressure reflexes when administered intraperitoneally (1·5 grm. per kilo).

given, but was discontinued after the complete setting up of the preparation as it was found that the urethane provided adequate, though light, anæsthesia. It was in this condition that the tracings appended were obtained. When the effects of stimulation were to be compared with those obtained under ether alone, the depth of anæsthesia was regulated so as to be as nearly as possible the same as under the urethane.

Sollman and Brown (2) were the first to describe the fall of systemic blood-pressure consequent on traction on the peripheral end of the common carotid artery. This can be very easily verified in dogs and cats (under ether) and rabbits, and the mechanism has been analysed by Hering. It is present in the rabbit even under ether anæsthesia, but the accompanying tracing (Fig. 1) demonstrates the remarkable effect of the change

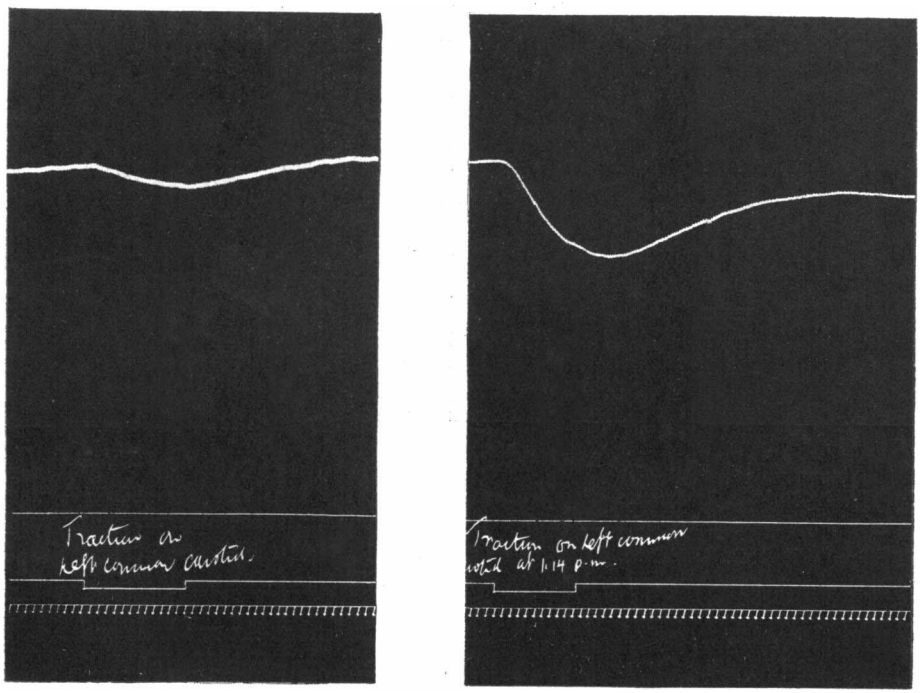
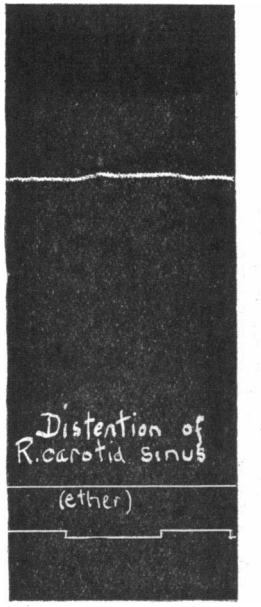


Fig. 1. Rabbit. Traction exerted on peripheral end of common carotid artery. Tracing shows slight fall of blood-pressure under ether and the pronounced fall under urethane anæsthesia. Time in seconds.

from ether to urethane anæsthesia. (In all cases the blood-pressure was measured in the femoral artery.)

With ether, traction on the peripheral end of the left common carotid artery produces a slight but perceptible fall. With urethane there is a very marked fall. That is to say, the urethane has "sensitised" the reflex, present to a slight degree under ether.

Fig. 2 demonstrates the same mechanism using inflation instead of



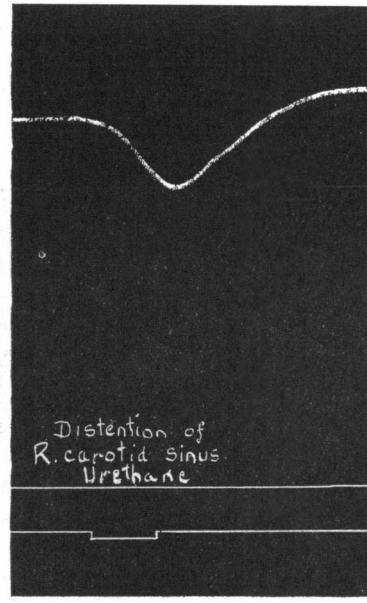


Fig. 2.

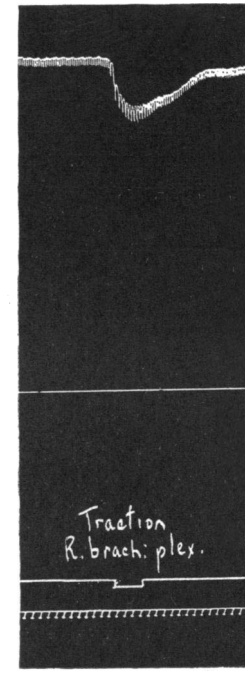


Fig. 3.

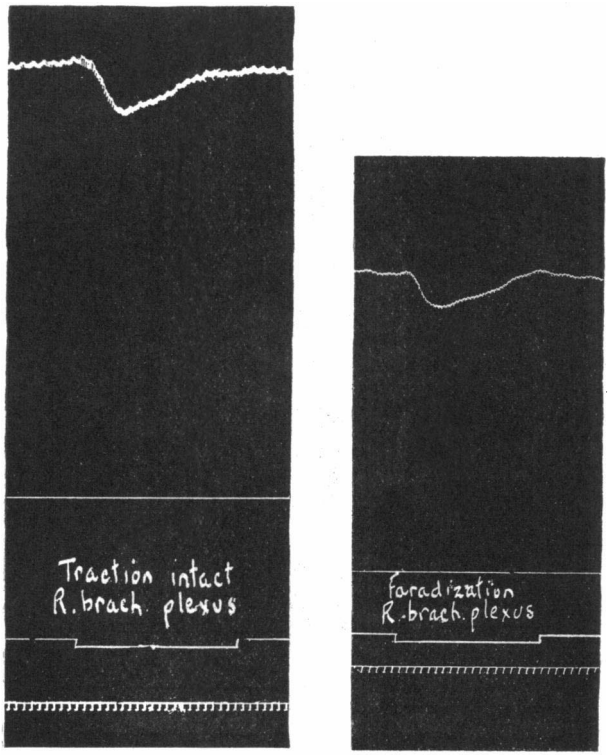
Fig. 2. Rabbit. Shows no effect from distension of the sinus caroticus under ether. A pronounced fall from the same procedure when urethane is substituted.

Fig. 3. Rabbit. Urethane. Traction on the central end of the cut brachial plexus. Shows depressor effect and slowing of the heart. Time in seconds.

traction as a mode of stimulus. In this experiment the internal carotid was tied as near the skull as possible. The external carotid was tied well above the bifurcation and all the small arterial branches visible in the neighbourhood were ligated. The sinus region was then inflated with saline through a syringe connected to a cannula inserted headwards into the common carotid artery. Under ether anæsthesia there was no perceptible reaction during inflation. When the change had been made to urethane a pronounced fall accompanied the distension. It was also

found that traction on the central end of the cut brachial plexus would produce, under urethane, a well-marked fall of pressure. This fall could be elicited after the removal of the stellate ganglion and the cutting of both vagi in the neck, or the administration of atropine. However, with the vagi intact there was also a slowing of the heart (Fig. 3). Under ether, traction on the plexus produced either a slight rise of pressure or no effect.

An interesting point associated with this depressor effect is the spontaneous recovery of the blood-pressure level which takes place despite the continuance of the stimulus (stretch or faradisation, Fig. 4).



a Fig. 4. *b*

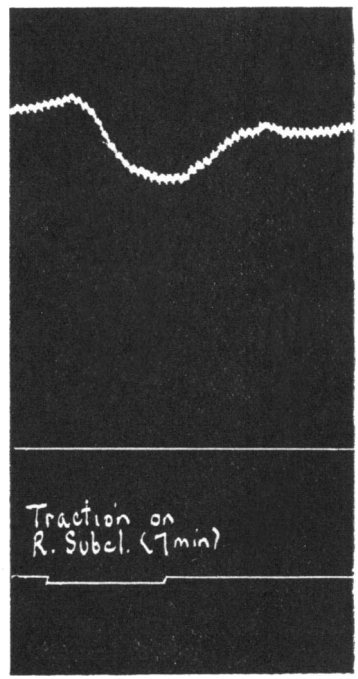


Fig. 5.

Fig. 4. *a*. Rabbit. Urethane. Shows return to normal blood-pressure during continuance of traction stimulation. *b*. Rabbit. Urethane. The same effect with faradic stimulation. Time in seconds.

Fig. 5. Rabbit. Urethane. Depressor effect from traction on the central end of the subclavian artery. Atropine given 7 minutes beforehand.

Traction on the central end of the subclavian artery was also found to produce a fall of pressure under urethane (Fig. 5) but this was analysed as being due to the traction on the artery being transmitted to the adjacent brachial plexus. Traction on a muscle in the rabbit (opening the jaws or stretching the quadriceps femoris) gives no effect or a rise in blood-pressure under ether anæsthesia. When however urethane has been substituted a depressor effect is obtained (Fig. 6).

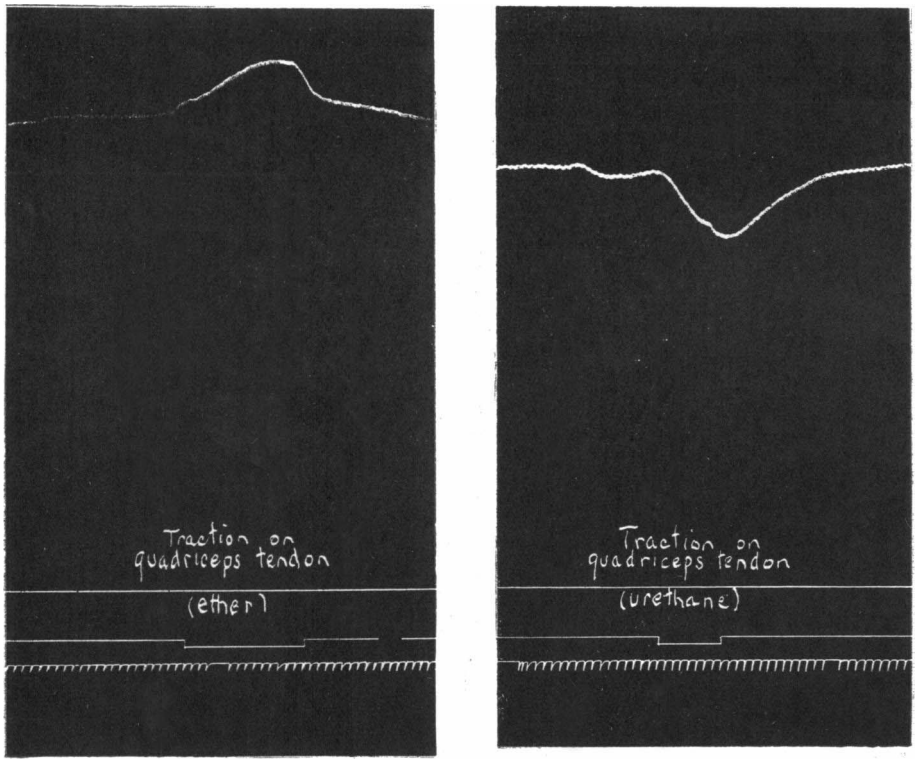


Fig. 6. Rabbit. Under ether traction on the quadriceps femoris produced, in this case, a rise of pressure. When urethane was substituted for ether there was a fall of pressure from the same procedure. Time in seconds.

Fig. 7 shows the result of faradisation of the central end of the femoral nerve with urethane anæsthesia. There is a considerable fall of blood-pressure.

It is clear, from the tracings and explanation given, that urethane, even when only producing light anæsthesia, is capable of influencing the rabbit's reactions so that depressor effects are obtained from a

variety of stimuli. The experiments herein described offer no explanation as to the mode of action of the urethane but, in view of the widespread

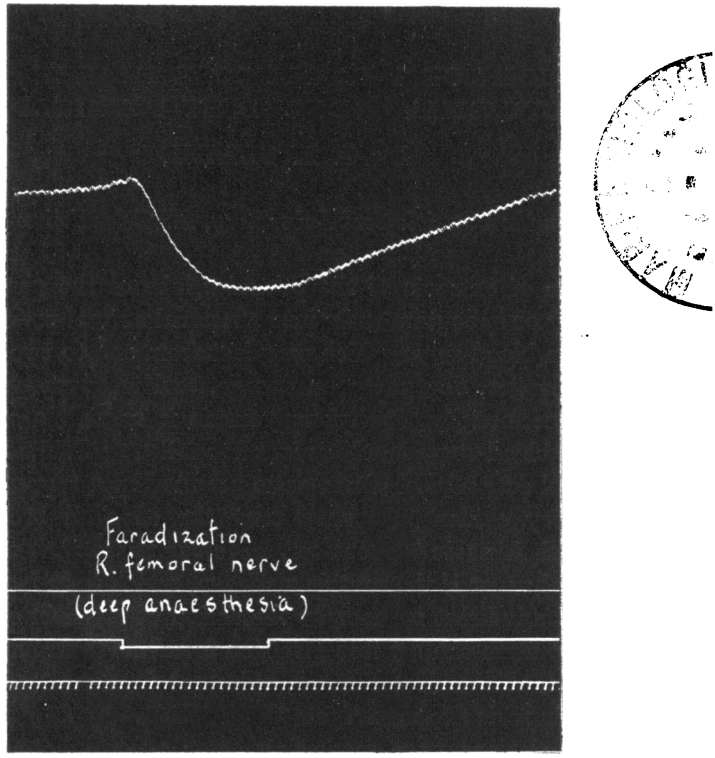


Fig. 7. Rabbit. Urethane. Shows the depressor effect from stimulation of the central end of the femoral nerve.

use of this drug, it was thought desirable to call attention to this disturbing factor in the evaluation of results.

Summary.

Under urethane anæsthesia a variety of stimuli, in the rabbit, produce depressor reflexes which are slight or absent under ether anæsthesia.

This work was done by H. F. while working under the Freedom Research Fund of the London Hospital.

REFERENCES.

1. H. E. Hering. Monograph. "Die Karotissinusreflexe auf Herz und Gefässe." 1927. Theodor Steinkopff. Dresden and Leipsig.
2. T. Sollman and E. Brown.[1] "The blood-pressure fall produced by traction on the carotid artery." Am. Journ. Physiol. 30. p. 88. 1912.