Pharmacology Biochemistry and Behavior, Vol. 1, pp. 113–115. ANKHO International Inc., 1973. Printed in the U.S.A.

BRIEF COMMUNICATION

A Simple System Allowing Rapid and Repeated Access to Implanted Venous Cannulae in the Conscious Rat

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(Received 25 October 1972)

HALL, G. H. AND J. M. GOODYEAR. *A simple system allowing rapid and repeated access to implanted venous cannulae in the conscious rat.* PHARMAC. BIOCHEM. BEHAV. 1(1) 113–115, 1973.–A system is described which allows rapid and repeated access to implanted venous cannulae in the conscious rat. The system, which consists of a skull-mounted cannula pedestal assembly, connector and dust cap can be produced quickly and at minimal cost from disposable hypodermic equipment.

Technique Intravenous injection Conscious rat Behaviour

VARIOUS techniques have been described for the implantation of intravenous cannulae in the rat. The external jugular is the vein usually chosen for cannulation and differing approaches have been used to seal, support and protect the exposed distal end of the cannula [1, 2, 3], which is exteriorized at the back of the neck [2, 3] or in the shoulder region [1]. However, these existing techniques do not circumvent the difficulties encountered when attempting to make an easy and satisfactory connection with the implanted cannula for injection, infusion or blood sampling. Similarly, the various devices at present in use for anchorage [1] or protection of the cannula [2], impose further limitations on the experimental situation which are particularly undesirable in behavioural studies. In an attempt to overcome these problems, we have designed a system which allows rapid and repeated access to implanted venous cannulae in the conscious rat. The system consists of a cannula pedestal assembly mounted on the skull, a connector and dust cap and can be produced quickly and at minimal cost from Becton, Dickinson sterile disposable hypodermic equipment or similar alternatives.

Construction of Cannula Pedestal Assembly, Connector and Dust Cap

(A) Cannula Pedestal Assembly. The body of the cannula pedestal assembly is formed from the plastic hub (a) of a 19G BD-Yale disposable needle, following removal of the needle (b) as shown in Fig. 1. The head (c) of a syringe plunger, from a 1 ml BD-Plastipak Tuberculin syringe, is cut away 8.5 mm from the end of the plunger (Fig. 1) and forms the base (c) of the assembly. The syringe plunger head (c) is then drilled through the centre with a No. 56 (0.046 in. dia.) drill, to accommodate a section of needle (d) from an 18G BD-Yale disposable needle. This section (d), cut to a length of 15 mm, is bent at a right angle at its centre and is then push-fitted into the hole drilled through the syringe plunger head (c). A narrow rectangular area is cut away from the flat rounded end of the syringe plunger head (c), to allow complete insertion of the needle (d) and a flush-fit with the base of the assembly. A rubber disc (2.75 mm dia., 2 mm thick), punched from the red rubber cap attached to the hub end of a Portex nylon intravenous catheter, forms the leak-proof seal (e) within the assembly. It is important that any rubber selected for the leak-proof seal (e) must be able to withstand the repeated entry of the 25G connector needle without breaking up, otherwise blockage of the implanted cannula or small blood vessels would ensue. The cannula pedestal is then assembled (see complete assembly, Fig. 1) by inserting the rubber seal (e) into the plastic hub (a), followed by the syringe plunger head (c) with the needle tube (d) in position. The rim around the base of the plastic hub (a) is heat-sealed to the base of the syringe plunger head (c) with a fine soldering iron, to ensure a leak-proof system. The circular base of the syringe plunger head (c) is then cut into a triangular shape, to minimize the area of skull covered by the assembly and to allow better placement of anchor screws in the skull bone around the assembly.

(B)-Connector and Dust Cap. The body (f) of the connector is formed from the needle guard of the disposable needle used in the construction of the cannula pedestal assembly. The upper section of the needle guard is cut away (Fig. 1), the part remaining (f) measuring 15 mm in length.

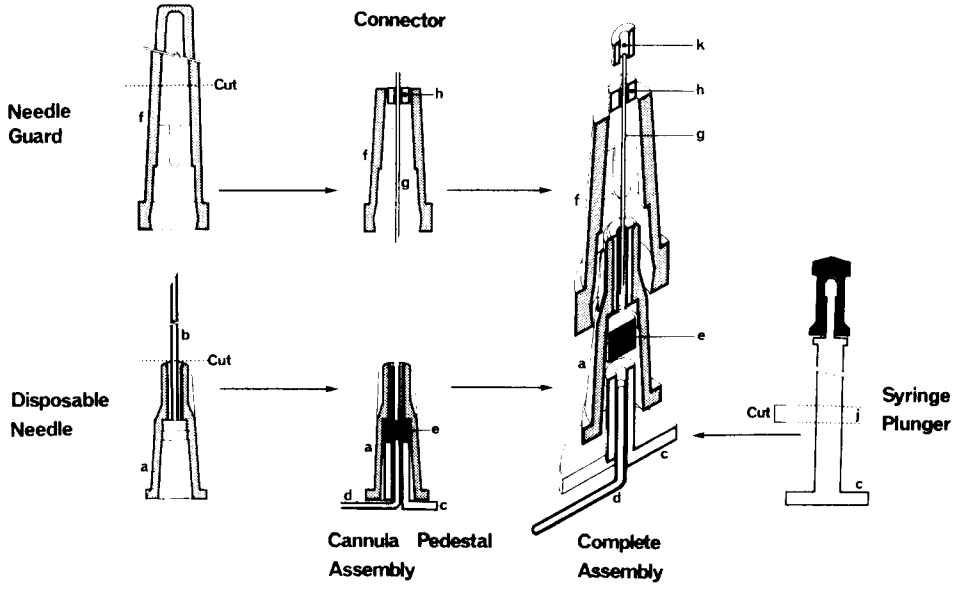

FIG. 1. Construction of cannula pedestal assembly, connector and dust cap. (a) plastic hub: 19G BD-Yale disposable needle, (b) needle: 19G BD-Yale disposable needle, (c) syringe plunger head: 1 ml BD Plastipak Tuberculin syringe, (d) needle: 18G BD-Yale disposable needle, (e) rubber seal, (f) needle guard: 19G BD-Yale disposable needle, (g) needle with portion of plastic hub (h) attached: 25G BD-Yale disposable needle, (j) small section of stem from syringe plunger, (k) polythene tubing.

The injector needle (g) used in the connector is from a 25G BD-Yale disposable needle and is removed with a small portion of the plastic hub (h) attached. The connector is assembled by inserting the needle (g) into the needle guard (f) and then heat-sealing the plastic hub (h) to the top of the connector body (f) as shown in Fig. 1. The needle (g) projects from the base of the connector by approximately 2 mm. When connection is made with the cannula pedestal assembly, the needle (g) must pass through the rubber seal (e) into the needle tube (d) and this determines the position of the needle (g) within the connector body (f). To construct the dust cap, a small section (j) of stem is removed from the syringer plunger and is heat-sealed into the top of the lower half of the needle guard (f). Excluding the needle (g), the dust cap and connector are therefore identical.

Application. The external jugular vein is cannulated with silicone rubber tubing (Silastic, Dow Corning, 0.012 in. ID), observing the usual aseptic precautions throughout all the operative procedures. The distal end of the cannula, temporarily sealed and consisting of a short length of Silastic silicone rubber tubing 0.03 in. ID attached to the cannula with Silastic Medical Adhesive Silicone Type A, is passed subcutaneously to the head and exteriorized through a small skin incision overlying the skull. The cannula is cut to a length which allows sufficient flexibility to compensate for movement of the animal and the distal end is then pushed on to the needle tube (d) of the cannula pedestal assembly. The base of the assembly and the three anchor screws placed in the skull around it, are covered with acrylic cement to ensure rigid attachement of the cannula pedestal to the skull bone. For injection, the injector needle (g) of the connector is inserted through the top of the cannula pedestal as shown in the complete assembly in Fig. 1. The connector is then pushed down on to the pedestal until the needle (g) pierces the rubber seal (e). The connector (f), which is matched to the plastic hub (a), is positioned so that it fits securely on to the cannula pedestal assembly. The pedestal assembly with dust cap attached weighs 0.70 g.

To make a single intravenous injection, the connector is attached to a syringe via a short length of polythene tubing (k). For continuous intravenous administration of a drug solution, the connector is attached via polythene tubing (k) and a leak-proof swivel joint (2) on line, to a syringe pump. The system is counterbalanced, allowing unrestricted movement and therefore minimal disturbance to the experimental animal. The effect of drugs administered intravenously on lever-pressing behaviour in a variety of operant situations can therefore readily be investigated.

Using the system described, experiments have been carried out for periods of up to three months without failure of the cannula pedestal assembly. During this time, the rubber seal was penetrated at least twice a day. Separate studies have indicated that the rubber selected for the leak-proof seal will accept these repeated needle penetrations without leakage of air into the cannula. Although the present system does not allow for the replacement of the rubber, it seems unlikely that problems associated with the latter will be limiting factors in this type of experiment.

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