

A TECHNIQUE FOR CHRONIC VENOUS CANNULATION IN SWINE

by

W. H. HARRIS*

*Department of Biomedical Sciences, University of Guelph,
Guelph, Canada*

SUMMARY

A technique for the implantation of an indwelling cannula into the jugular vein of mature swine is described. Cannulas have been functional for up to 77 days. The indwelling cannula enables the investigator to collect sequential blood samples or inject substances without restraint or excitement of the animal.

Blood samples from swine are frequently obtained by puncture of the anterior vena cava. Because of the depth at which the vein is located in adult swine, a 2 × 102 mm (14 gauge, 4 inch) needle is required. This procedure requires physical restraint of the animal and results in excitation. In research, where it may be necessary to draw blood samples several times a day, the venipuncture technique becomes impractical. A technique for use in 40 kg swine has been described by Christison & Curtin (1969), but their method proved unsatisfactory when tested in mature swine in our laboratory. Because repeated blood sampling of adult female swine, without restraint or anaesthesia, was required, a new technique was developed.

MATERIALS AND METHODS

The cannulas used were vinyl tubing of internal diameter 3.2 mm, outside 4.8 mm, wall thickness 0.8 mm ($\frac{3}{8}$, $\frac{5}{16}$ and $\frac{1}{4}$ in respectively: (Becton, Dickinson & Co., Rutherford, New Jersey 07073, U.S.A.). About 1 m of tubing was autoclaved for each operation, and then shortened to suit the individual animal. The internal surface of some cannulas was coated with graphite to prevent clotting (Gott, Whiffen & Dutton, 1963; Folts, 1971), however no difference in the number of blood clots could be observed in the cannulas, with or without graphite. The use of graphite was subsequently discontinued.

The anaesthetic procedure used was the thiopentone-curare-nitrous oxide regime for swine (Cummings, Harris & Agar, 1972), with the modification that 0.5-1.0% methoxyflurane was used throughout the entire procedure. The

*Present address: Faculty of Medicine, Department of Pharmacology and Therapeutics, University of Calgary, Calgary, Alberta, Canada.

heart rate and electrocardiogram were monitored during the operation by means of an oscilloscope (Model ORM-1; Electronics for Medicine Inc., 30 Virginia Road, White Plains, New York 10603, U.S.A.).

With the sow in lateral recumbancy, the skin was incised in the jugular groove. Using blunt dissection, the jugular vein was located and dissected free for a distance of approximately 10 cm. In heavier sows, the vein may be up to 8 cm beneath the skin. The vinyl cannula was passed by means of a trochar and cannula under the skin from a point above the shoulder to the jugular vein (Fig. 1). The cannula was filled with sterile saline and clamped.

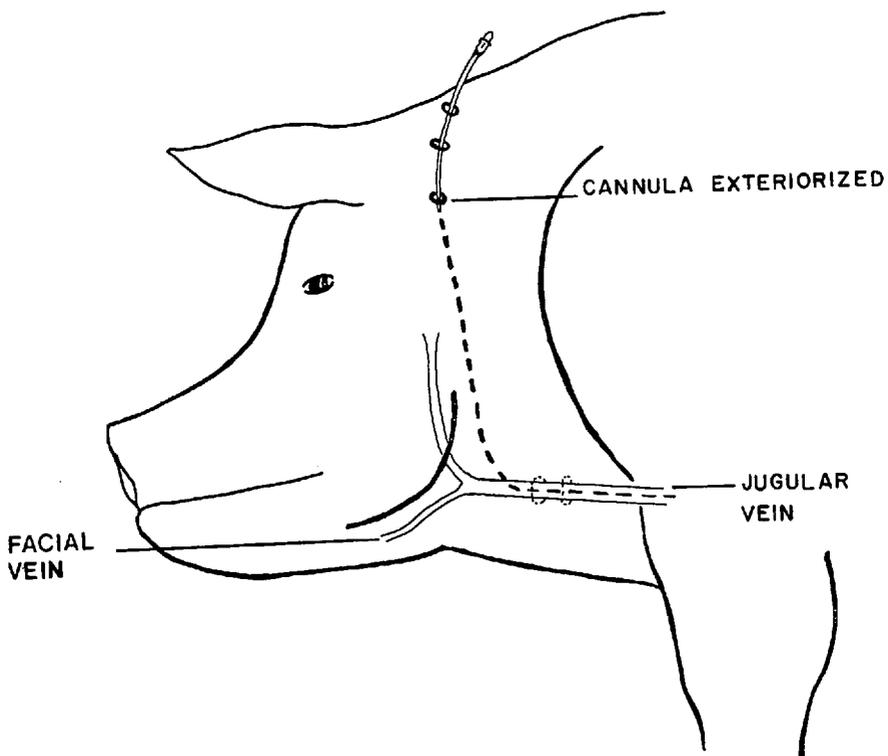


Fig. 1. Diagram to show the position of the cannula relative to external facial features of the pig.

The saline was used to avoid the introduction of air into the vein. 2 silk ligatures (No. 3 silk) were placed around the jugular about 5 cm apart and the cranial one tied, completely occluding the vein. The cannula was inserted into the jugular vein a distance of about 25 cm until a change in heart rate and electrocardiogram was noted. The tachycardia and arrhythmia indicated that the cannula had touched the sino-atrial node. The cannula was withdrawn approximately 3 cm and tied securely in place. Several silk sutures

were used to anchor the cannula to neck muscles. This method of placing the cannula was used to ensure that the tip of the cannula was in the vena cava. If the tip was in the jugular vein, it was found that the vein collapsed around the cannula making it impossible to withdraw blood samples.

The neck incision was closed and the distal portion of the cannula trimmed so that approximately 15 cm of cannula was exteriorized. This part was securely sutured to the skin along the dorsal midline by means of umbilical tape. A male-luer fitting syringe with a tubing connector was inserted into the open end of the cannula and sealed with a metal cap. The cap was less likely to catch on the pen wall than a stopcock. The point at which the cannula emerged from under the skin was coated with friar's balsam to seal it from bacteria. This application was repeated at weekly intervals and found to be very effective. The cannula was filled with 5 ml of sterile, heparinized saline (400 i.u. per ml). Flushing of the cannulas was performed on alternate days to avoid clotting.

20 sows ranging in weight from 160 to 246 kg were cannulated for various experiments. The sows were housed in farrowing crates in a barn in which the temperature was maintained at 18°C. Food was withheld for 24 hours and water for 12 hours before the operation.

RESULTS AND DISCUSSION

The cannulas have been maintained for periods of time ranging from 4 to 77 days. The average length of time that a cannula was kept open was 33 days. It was found that cannulation of the facial vein as described by Christison & Curtin (1969) was unsatisfactory because in mature swine the facial vein joins the jugular vein under the ramus of the mandible. The sharp angle resulted in kinking of the cannula. In addition, the sows had such an extensive fat layer over the neck, that the facial vein was too deeply buried under the mandible for easy access. An attempt to use non-occluding cannulas was abandoned because of the difficulties encountered in placing a purse-string-suture in the wall of the jugular that was 8 cm below the skin incision.

The use of farrowing crates made it possible to collect blood without restraining the animal. It was found that most sows readily adapted to the crates and to the blood sampling procedures. However, confinement in the crates for several weeks did result in some sows developing stiff legs and sores on the feet. These problems were overcome by taking the sows out of the crates for exercise and by the use of deep bedding.

It is imperative that sterile procedures be used in the implantation operation, in flushing the cannulas and drawing blood samples. If sterile syringes and solutions are not used, bacteria may be introduced. Pulmonary abscesses were found in 5 sows on autopsy. It appeared that the infection had been introduced via the cannula and the bacteria transported to the lungs with

the venous blood where they caused the abscess. One sow developed a septicemia, but responded to antibiotic therapy.

ACKNOWLEDGEMENTS

Sincere appreciation is expressed to Mrs J. Lee and Mr R. Braham for their technical assistance.

This research was supported by the Ontario Ministry of Agriculture and Food and the Research Advisory Board, University of Guelph.

REFERENCES

- Christison, G. I. & Curtin, T. M. (1969). A simple venous catheter for sequential blood sampling from unrestrained pigs. *Laboratory Animal Care* **19**, 259.
- Cummings, J. N., Harris, W. H. & Agar, J. L. (1972). Anaesthetic regime for prolonged operations in swine. *Canadian Anaesthetists' Society Journal* **19**, 557.
- Folts, J. D. (1971). Preparation of a chronic indwelling catheter using a commercial infant feeding tube. *Journal of Applied Physiology* **30**, 417.
- Gott, V. L., Whiffen, J. D. & Dutton, R. C. (1963). Heparin bonding on colloidal graphite surfaces. *Science, New York* **142**, 1297.