

## LETTERS TO THE EDITOR

### Ectopic Ventricular Arrhythmia after Coronary Occlusion in the Indian Domestic Pig

SIR,—Sudden marked narrowing or a complete ligation of the anterior descending branch of the coronary artery in the pig is reported to result in 100 per cent mortality within 15 min. (Blumgart, Zoll, Freedberg and Gilligan, 1950). The only purposeful effort made on the genesis of arrhythmia from coronary occlusion in the pig was that of Winbury, Lorraine, Nicholas and Zitowitz (1960). Their preliminary pilot study on "miniature pigs" did not favour even a remote possibility of using the pig for such studies, because no ectopic ventricular rhythm was demonstrable; but the myocardium was sensitised to the ectopic provoking action of adrenaline. In a searching analysis of the problem of coronary artery disease, Sir H. Florey (1960) in his Jephcott lecture, declared that it might not be going too far to believe that the same factors were operating to produce the lesion in the pig as the one present in man, and that it may now be possible to elaborate observations made on man in a more comprehensive manner on animals. A reappraisal of the feasibility of using the domestic pig was, therefore, deemed pertinent. The present study set out to examine the possibility of developing the animal for use in a study of ectopic ventricular arrhythmia by a 2-stage coronary artery ligation. To our knowledge this is the first time that successful experimental induction of a delayed development of ectopic ventricular arrhythmia in the pig has been reported.

Twenty domestic pigs, raised and maintained in our laboratory, aged 6 to 8 months and weighing 15–25 kg., were chosen for the experiment. The two-stage ligation technique of Harris (1950) was adapted to occlude aseptically the anterior descending branch of the left coronary artery; the size of the probe over which the first ligature was tied was of 0.45 mm. diameter. Intravenous pentobarbitone sodium (35 mg./kg.) was used for general anaesthesia. No parenteral antibiotics were used; neomycin-bacitracin-sulphacetamide powder was dusted on before closure of the chest in layers.

The site of the ligature at which the ectopic ventricular arrhythmia developed in the pig is shown below to be much lower down on the artery than in the dog.

Group	No. of pigs used	Distance from the ostium of the Lt. coronary artery	Result
I	5	1.6–2.0 cm.	Immediate fatal ventricular fibrillation
II	5	2.1–2.5 cm.	Reversible delayed ventricular fibrillation
III	5	2.6–3.0 cm.	Delayed ectopic ventricular arrhythmia
IV	5	3.1–4.0 cm.	A few ectopic beats

The incidence of the development of an immediately fatal ventricular fibrillation was directly proportional to the proximity of the ligature to the origin of the left coronary artery.

After recovery from the anaesthesia, ventricular ectopic arrhythmia developed gradually in 2–3 hr. after a complete occlusion in Group III, as recorded on a 4-channel ink-writing electrocardiograph. Intense ectopic activity was maintained from about 6 to 28 hr., after which it was observed to be interpolated more and more frequently with a sinus rhythm. The normal sinus rhythm was almost always evident by about 48 hr. after ligation. The latent period of

development of the ventricular ectopic rhythm with tachycardia was unrelated to the arousal of the animal from anaesthesia.

While the spontaneous ventricular arrhythmia gradually disappeared over a period of 3 days, the exaggerated ectopic responses to noradrenaline persisted for about 7 days as shown in Fig. 1.

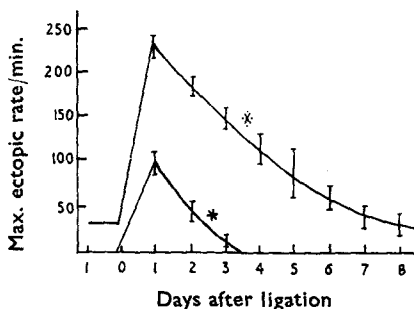


FIG. 1. Ectopic ventricular arrhythmia after coronary occlusion. Upper curve after noradrenaline, 8 µg./kg. i.v. Lower curve—spontaneous.

The 5 pigs developing the delayed ectopic ventricular arrhythmia in Group III survived, and were killed for histological study of the hearts. In the hearts of these animals, a month after ligation, the corresponding areas of the left ventricle were observed to have undergone a massive necrosis leaving a fibrotic thinned out part of the ventricular wall.

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Department of Pharmacology,  
All-India Institute of Medical  
Sciences, New Delhi-16, India.

R. B. ARORA  
D. S. SIVAPPA

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#### Observations on Conditioned and Unconditioned on- and off- Behavioural Responses to a Buzzer

SIR.—Responses occurring at the initiation of an afferent stimulation are called on-responses, and those occurring at its cessation, off-responses. Conditioned on- and off- responses have been studied at the behavioural level by Galeano, Roig, Segundo and Sommer-Smith (1959), Sommer-Smith, Galeano, Piñeyrúa-Payssé, Roig and Segundo (1962), Izquierdo and Östman (1961a,b) and Izquierdo (1962a). Further observations on the subject are added here.

The experiments were made on 17 adult albino rats. The noise of a buzzer acting during randomly variable periods separated by randomly variable silent