

logically tested inulin are no more frequent than with other intravenous infusions of like duration. Scrupulous care must be observed with respect to the saline and the infusion apparatus. From experience with over 250 infusions carefully observed for reaction, we place considerable confidence in Sterisol saline bottled in pyrex ampoules. The rubber tubing, before being put into use, should be thoroughly cleaned by filling it with N NaOH, stoppering the ends and rolling it vigorously so that the lumen is cleaned by friction, which process removes astonishingly large quantities of particulate material from the best "intravenous" clear gum rubber tubing. It is then rinsed and sterilized by boiling. It must be washed at once and with particular care after use with inulin solutions to prevent the inulin from crystallizing out and adhering to the walls or in small crevices, since these slight incrustations may be a source of reaction.

9713 P

Hemodynamic Effects of Subcutaneous, Submucosal, and Subgingival Injections of Procaine-Epinephrine Hydrochloride Solutions.

PAUL P. PICKERING, H. P. STEINMEYER AND ARNO B. LUCKHARDT.

From the Department of Physiology and Walter G. Zoller Memorial Dental Clinic, University of Chicago.

The investigations of Luckhardt and Koppanyi¹ were concerned with the pressor effects of epinephrine hydrochloride injected subcutaneously and the effect of massage thereon. In the present work, two problems and their ramifications have been and are being studied. First, the absorption of epinephrine from injections in subcutaneous areas as compared with submucosal injections in the oral cavity. Secondly, the effect of subgingival injections of procaine-epinephrine hydrochloride solutions. Conclusions were drawn from a comparative measurement of the blood pressure changes as evidenced from these injections.

Dogs, 38 in number, were used in the series of experiments. An area on the chest wall was selected for the subcutaneous injections, whereas a site in the dog's mouth at the mucobuccal fold offered an easily accessible area for the submucosal injections. In some of the

¹ Luckhardt, Arno B., and Koppanyi, Theodor, *Am. J. Physiol.*, 1927, **81**, 436.

animals the subcutaneous injections were made prior to the submucous injections, whereas on others the order of procedure was reversed to avoid any misinterpretation of results from the influence of previous epinephrine deposits.

Following submucosal injections, a rise in blood pressure ranging between 10-40 mm. of Hg. was noted. These rises were greater than those recorded from similar injections in the subcutaneous tissue, the greatest being 10 mm. of Hg. The time required for the blood pressure to return to a normal level was slightly greater following submucosal injections.

Following the technique described by Luckhardt and Koppányi¹ and Koppányi and Luckhardt,² the areas of injection were massaged lightly. The massage of the 2 sites resulted in a greater pressor response from the submucous injection.

The second series of experiments was concerned with the pressor responses from various concentrations of procaine-epinephrine deposited in several selected sites in the mouth of the dog.

The procaine (2%)-epinephrine solutions ranged in epinephrine concentration from 1/10,000 to 1/30,000, all injections having a volume of 2 cc. regardless of site of injection or size of dog.

Several areas for deposition of the solution were selected, namely: (1) In the region of the posterior palatine foramen (Fig. 1A). (2) Into the mental foramen of the mandible (Fig. 1B). (3) In the region of the mandibular foramen (Fig. 1C). (4) Into the anterior palatine foramen (Fig. 1D).

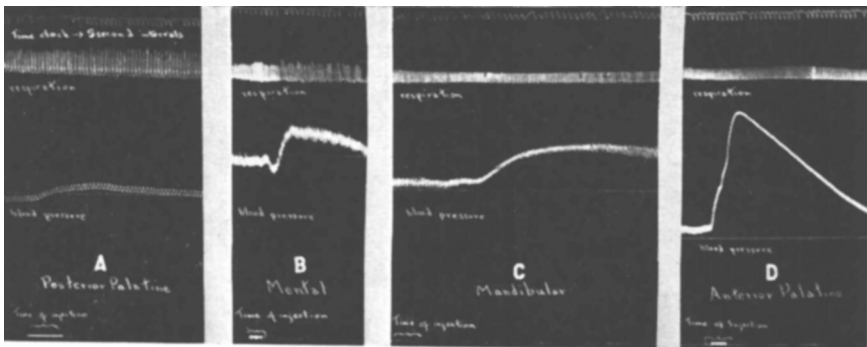


FIG. 1.

Effects in dogs of subgingival injections of procaine-epinephrine solutions on the blood pressure and the respiration when, A, the solution is injected into the posterior palatine region; B, into the mental foramen; C, into the region at the mandibular foramen; D, into the anterior palatine foramen.

² Koppányi, T., and Luckhardt, Arno B., *Arch. Int. de Pharm. et de Ther.*, 1931, **40**, 345.

The effects of these injections, as shown in Fig. 1, are representative of the results obtained in this series of experiments and as can be seen from the records, appreciable elevation of the general carotid blood pressure followed these subgingival injections. The most striking result is observed following injections in the region of the anterior palatine foramen in the soft tissues over the hard palate (D). The great increase in blood pressure from injections in this area as compared with any other injection was uniform throughout this second series. To meet the objection that these rises might have been due to reflex effects because of the pressure necessary for injection of the solution, physiological saline in the same and in much greater quantities was deposited, showing no pressor response.

Descriptive anatomy, Ellenberger and Baum,³ of the afferent and efferent vessels of the areas under observation, indicates a slightly greater vascularity in the anterior palatine region as compared with the posterior palatine region. A report by Schwartz⁴ suggests, furthermore, that there is a difference in sensibility of blood vessels to the local constrictor effect of epinephrine, which might account for the rather uniform differences noted in Figures 1A and 1D.

In studying the effects of subgingival injection of procaine-epinephrine, we cannot refrain from pointing out, even in this preliminary report, the implication of the results so far obtained, namely: (1) That subgingival injections of even dilute concentrations of epinephrine (1/30,000) may and do often cause marked rises in the blood pressure. (2) That if epinephrine, a local vasoconstrictor, reaches the general circulation in appreciable quantities so does procaine which itself is a vaso-dilator. (3) That in dental practice the patient is given, commonly, the same or repeated doses of the same concentration of procaine-epinephrine solutions irrespective of age or size of the individual and without previous physical examination of the patient as to the presence of a myocardial insufficiency, hypertension, or arteriosclerosis.

³ Ellenberger, W., and Baum, H., *Anatomie des Hundes*, Verlag von Paul Parey, Berlin, 1891, pp. 376-387.

⁴ Schwartz, M. S., *Dental Items of Interest*, 1937, **59**, 851.