Proceedings of the
STAFF MEETINGS OF THE MAYO CLINIC

Published Fortnightly for the Information of the Members of the Staff and
the Fellows of the Mayo Foundation for Medical Education and Research

Volume 25   Rochester, Minnesota, Wednesday, July 5, 1950   Number 14

CONTENTS

Symposium on In Vivo Photometry of Blood in Human Beings

An Introduction to the Clinical Applications of Oximetry
HOWARD B. BURCHELL

A Single Scale Absolute Reading Ear Oximeter
EARL H. WOOD

A Study of the Oxygen Saturation of Arterial Blood of Normal
Newborn Infants by Means of a Modified Photo-electric Oximeter:
Preliminary Report
ELMER L. CREEHAN, ROGER L. J. KENNEDY AND EARL H. WOOD

Measurement of Blood Content and Arterial Pressure in the Human Ear
EARL H. WOOD, JULIAN R. B. KNUTSON AND BOWEN E. TAYLOR

Studies on Circulation Time With the Aid of the Oximeter
JULIAN R. B. KNUTSON, BOWEN E. TAYLOR, EUGENE J. ELLIS
AND EARL H. WOOD

A Plastic Needle
DAVID J. MASSA, JOHN S. LUNDY, ALBERT FAULCONE, JR.
AND ROGER W. RIDLEY

Recent Publications by Members of the Staff

AN INTRODUCTION TO THE CLINICAL APPLICATIONS
OF OXIMETRY

Howard B. Burchell, M.D., Ph.D. in Medicine, Division of
Medicine: While photo-electric determination of the saturation of
blood with oxygen was used in Europe prior to World War II, it was
in its application to wartime problems in flying that it was used
extensively in this country. During the war years, photo-electric
determinations of the oxygen saturation of the arterial blood by using
an ear oximeter were used in the Royal Air Force, the German Air
Force and the United States Air Force, and in the last-named air force,
it had a widespread application in the training of fliers. It was par-
ticularly valuable in the demonstration that desaturation of the arterial
blood occurred independently of the presence of cyanosis, when pros-
pective or actual air crews were indoctrinated by simulated ascents to
altitude in low pressure chambers. It was evident that after the war
ear. The abnormally decreased circulation times present in venous-arterial intracardiac shunts have been previously noted by Benenson and Hitzig.10

The high degree of recirculation and dilution in the pulmonary-cardiac circulation made it impossible to determine the arm-to-tongue time with either macasol or decholin in this patient. As could be expected, the ether circulation time was essentially normal.

Figure 3d is the recorded dye injection curve obtained from a 14-year-old girl who had ventricular septal defect with a practically normal right ventricular pressure. The dye which was detected at the ear 9.4 seconds after the start of the injection into the antecubital vein was probably carried by blood which passed through the pulmonary circuit in the normal manner. The secondary increase in concentration of dye at the ear was presumably the additive effect of the portion of the dye which, returning from the lungs on its primary circuit, was recirculated through the ventricular defect and mixed with the dye still present in the right ventricle. This resulting secondary increase in concentration of dye in the right ventricle is subsequently reflected at the ear when this blood passes through to the systemic circulation. It is also noted that the output of the red photocell returns toward the initial base line slower than the normal (fig. 2a), presumably owing to the continued recirculation of a decreasing proportion of the dye in the pulmonary circuit.

Figure 3e is a dye injection curve recorded from a 36-year-old woman who had a superior vena caval obstruction. Her venous pressure, determined in the supine position, was 26.4 cm. of water in the arm and 12.4 cm. at the ankle. The arm-to-ear circulation time of methylene blue was increased to 32 seconds and the contour of the dye injection curve is definitely abnormal. The inability of this amount of dye to produce an abrupt deflection of the red galvanometer beam further substantiates stasis of the circulation, permitting dilution of the dye-containing blood with normal blood. In this instance the dilution is not as marked as in figure 3d.

Summary

Application of the oximeter to the objective determination of circulation times to various parts of the body and for obtaining dye injection curves has been described. It is suggested that these procedures may prove of value in studies of various pulmonary and cardiac disorders.


---

A PLASTIC NEEDLE

David J. Massa, M.D., Fellow in Anesthesiology, Mayo Foundation, John S. Lundy, M.D., Albert Faulconer, Jr., M.D., M.S. in Anesthesiology and Roger W. Ridley, M.D., M.S. in Anesthesiology, Section on Anesthesiology: The needle consists of a short length of transflex tubing of suitable diameter, fixed at one end to a hub and tapered to its inside diameter at the free end, through which a steel needle has been passed as a styllet.

TECHNICAL DETAILS

The styllet-needle is a 3-inch no. 19 Becton-Dickinson needle (fig. 1a). The cannula hub is a shortened no. 16 Becton-Dickinson needle, the shaft of which is reduced to a length of 3/4 inch and is shallowly notched in several places to provide for a firm junction with the tubing (fig. 1a). The transflex tubing used is no. 22, in 3-inch lengths, and is referred to as the "cannula" (fig. 1a).

---

![Fig. 1. Details of the assembly of the plastic needle.](image-url)

The 3-inch length of tubing is soaked in acetone for two minutes and is rinsed in water for a few seconds. The limp enlarged tube is then slipped over the styllet-needle, which has been passed through the cannula hub, care being taken not to perforate the soft tubing with the needle point (fig. 1b). With the tube in place over the shaft of the cannula hub, it is allowed to dry 10 minutes. The tip (1 inch) of the plastic needle is again dipped into acetone for two minutes, rinsed quickly in water and allowed to dry ten minutes. The entire assembly is autoclaved twenty minutes in a cotton-stopped test tube. When the assembly is cool, a smooth taper is carefully placed on the tubing with a rotary cloth buffer, so that the edge of the tubing coincides with the bevel of the needle (fig. 1c). This process will eliminate the square "shoulder" at the junction of the free end of the

*Tube manufactured by the Irvigton Varnish and Lacquer Co., Irvington H, New York. The plastic needle, completely assembled, can be obtained from the Rochester Products Company, Rochester, Minnesota.
cannula and the stylet-needle. Finally, the plastic needle is sterilized by autoclaving for twenty minutes at 15 pounds' pressure.

Fig. 2. Technique of vein puncture when the plastic needle is used.

**USE OF NEEDLE**

The plastic needle is introduced into a vein, as is any ordinary needle (fig. 2a). When the needle has been advanced so that the tip of the cannula is well into the vein, the stylet-needle is withdrawn approximately ¼ inch (fig. 2b), and with a gentle forward motion on the cannula hub, the needle is advanced as far as desired. The stylet-needle is then removed entirely, and any fluid desired is attached to the cannula hub (fig. 2c).

The cannula hub may be fastened in the usual manner with adhesive tape.

**ADVANTAGES AND APPLICATIONS**

The cannula has the advantages that it will rarely puncture the wall of the vein as does a steel needle, its flexibility allows a greater degree of comfort for the patient, and introduction is simpler than the introduction of a plastic tube through a steel needle.