PRACTICAL PROCEDURES IN CLINICAL MEDICINE

By

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PREFACE

THE object of this book, written primarily for senior students, house physicians, registrars and general practitioners, is to describe the practical procedures commonly used in the investigation and treatment of medical patients. The term " practical procedures " includes not only minor operations such as lumbar puncture, aspiration of the chest and blood transfusion, but also biochemical tests and radiological investigations. The practical details of the minor operations are intended to provide a basis from which variations may be made according to subsequent personal experience and idiosyncrasy. Simple biochemical tests, which have become part of the routine examination of the patient, are described in detail, and also those which the clinician may wish to perform in an emergency when the laboratory is closed. It is not intended to describe the technical details of the more complicated biochemical and hæmatological investigations which are the province of the clinical pathologist ; but the physiological basis, application and interpretation of these tests are mentioned because without this knowledge the clinician cannot appreciate their value and limitations.

Dr. J. W. Pierce, M.D. (London), M.R.C.P., D.M.R.D., Radiologist to St. Thomas's Hospital, London, has contributed the chapter on Radiology in Clinical Medicine, and Dr. Geoffrey H. Tovey, M.D. (Bristol), Director of the South-West Regional Blood Transfusion Service and Special Lecturer in Hæmatology, Bristol University, the chapter on Parenteral Infusions. The Section on Aspiration of Joints has been written by Dr. G. R. Fearnley, M.D. (London), M.R.C.P., Masonic Fellow in Rheumatic Diseases, New York University, and on Dietetics by Miss M. Pemberton, Dietitian-in-Charge, St. Thomas's Hospital, London. All the drawings, except those acknowledged below, are the work of Miss Patricia Burrows. Mr. E. V. Willmott, F.R.P.S., took the photographs. My thanks are due to Dr. M. D. Collins for drawing Figs. 22–24 and 56, to Messrs. Allen and Hanbury for Fig. 21, to Messrs. Hamblin for Fig. 42, to Messrs. Hawksley for Figs. 13 and 46, to Messrs. Lea and Febiger for Figs. 14 and 62 and to the Editor of the *Lancet* for Fig. 57. Mr. E. Blackburn of Messrs.

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CHAPTER I

INJECTIONS AND THE COLLECTION OF BLOOD

ALTHOUGH the taking of blood and giving of injections are everyday occurrences in medical practice, doctors should not forget that many patients view such procedures with apprehension. It is important therefore that the operator should cause as little discomfort as possible by acquiring the necessary skill. This comes by practice, confidence and a thorough understanding of the apparatus.

SYRINGES

Most syringes used in clinical medicine are of two main types. "*All-Glass*" *Syringes* have a glass barrel and a glass piston. They are more easily cleaned, and less liable to break when heated. They can be sterilised, already assembled, in a hot air oven or autoclave. The chief disadvantage is the fragile glass nozzle, but this has recently been overcome by making "all-glass" syringes with a metal nozzle, held in place with a cement which will withstand a temperature of 160° C. "*Glass-Metal*" *Syringes* have a glass barrel and a metal piston and nozzle. Owing to the unequal expansion of the barrel and the piston, these syringes must be dismantled before being sterilised, which is carried out by boiling because the temperature in a hot air oven may melt the cement at the glass-metal junctions. Syringes of the "glass-metal" type are now being made with ceramic pistons which have the same coefficient of expansion as glass. The metal nozzle and ring at the end of the barrel are fixed to the glass with special cement so that these syringes, already assembled, can be sterilized in a hot air oven or autoclave.

Syringes are available in different sizes ; those in general use have a capacity of 1, 2, 5, 10, 20 and 50 ml. Special syringes have been designed for special purposes. Tuberculin syringes, which have a capacity of 1 ml., are used for injecting small quantities of fluid when performing a Mantoux (p. 221) and other skin tests (p. 414), and an insulin tolerance test (p. 312). Syringes with an eccentric nozzle are convenient when carrying out venepunctures (*infra*). The nozzle of a syringe is usually either Luer or Record fitting. The former is larger and found on all-glass syringes with

glass nozzles and on some glass-metal syringes. The latter is smaller and confined to glass-metal (Record) syringes and all-glass syringes with metal nozzles.

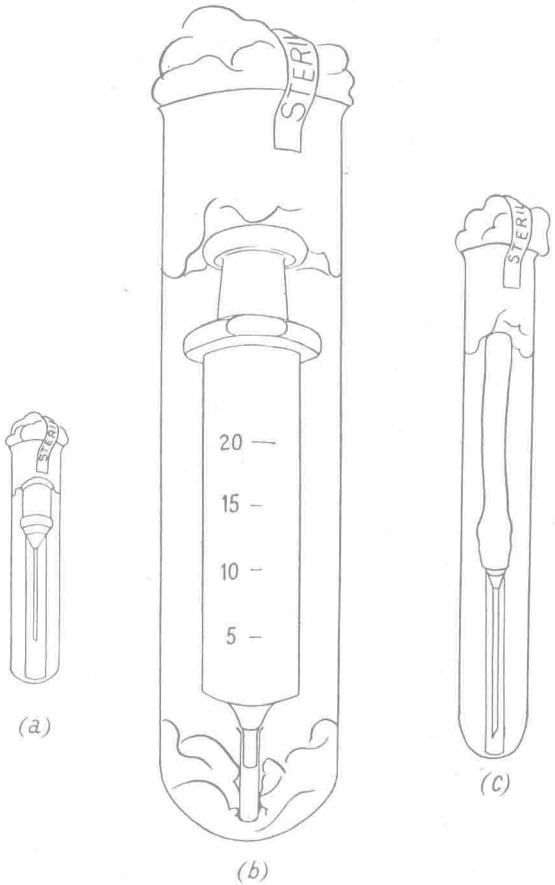

FIG. 1. Dry-sterilised syringe and needles. (*a*) 22-gauge, 1-inch needle, (*b*) 20 ml. "all-glass" syringe, (*c*) 18-gauge needle for venepuncture.

Sterilisation.[1] The dangers of inadequate sterilisation cannot be stressed too strongly. Cellulitis, abscess-formation, septicæmia,

[1] *The Sterilisation, Use and Care of Syringes. War Memorandum No.* 15. Medical Research Council. His Majesty's Stationery Office, London, 1945.

hæmatogenous hepatitis, tetanus, and gas-gangrene may be caused by unsterile syringes and needles. No method of sterilisation is reliable unless the apparatus is thoroughly cleansed of dirt and coagulable protein after use. Nor can adequate sterilisation prevent infection if by faulty technique the syringe and needle become contaminated during assembly or at the bedside.

Dry Heat. Complete bacteriological sterility of syringes is achieved by sterilisation in a hot air oven or an autoclave. Such treatment is suitable only for the all-glass type of syringe, and in hospitals and clinics a syringe service should be organised to supply sterile syringes to the wards and out-patient departments. New syringes are washed in soap and water, rinsed in clean water and dried. The tip of the piston is moistened with liquid paraffin which is rubbed with a finger into the ground surface of the piston. The plunger is inserted into the barrel and worked backwards and forwards to ensure a smooth action. The syringe is placed in a large hard-glass boiling-tube with its nozzle resting in a Durham tube. This prevents cotton-wool adhering to the nozzle. The mouth of the boiling tube is sealed with cotton-wool held in place with a strip of gummed paper on which is written the date of sterilisation and other relevant details (Fig. 1). The syringe is sterilized by placing the boiling-tube in a hot air oven at 160° C. for one hour, or in an autoclave at 120° C., 15–20 lbs. pressure, for twenty minutes.

Boiling. Glass-metal syringes, and all-glass syringes in the absence of an autoclave or hot air oven, are sterilised by boiling which destroys all pathogenic bacteria except those that produce resistent spores. Breakages will be avoided if the following points are noted : (1) the barrel and piston are taken apart and wrapped separately in gauze before being placed in the steriliser ; (2) the water in the steriliser must be only warm and should be brought gradually to the boil ; (3) other instruments should not be sterilised at the same time.

After the water has boiled for at least five minutes, the gauze wrapping is removed with sterile forceps before the barrel and piston are lifted from the steriliser, and placed in a dry sterile receiver covered with a piece of sterile lint or a sterile towel. When the barrel and piston are dry and cool, the syringe is assembled with the aid of sterile forceps or with clean dry fingers, taking care to touch only the outside of the barrel and the handle of the piston.

The practice of boiling syringes and then storing them in alcohol

is undesirable. By repeated use the alcohol becomes diluted and contaminated with organisms. Before being used, the syringe must be washed in sterile water or saline, which may be contaminated unless taken from a previously unopened autoclaved bottle.

Chemical Disinfectants. Chemical disinfectants cannot be relied upon to sterilise syringes, and should be used only in special circumstances. The only substance which can be recommended in any way is 70–75 per cent. alcohol. This may destroy vegetative bacteria but not spores. The barrel and piston should be immersed separately in the spirit for at least five minutes, and preferably kept in spirit until required for use. This method is only permissible when a syringe is used for injecting a sterile fluid such as insulin, into one person, and is reserved solely for this purpose.

Hollow Needles

Hollow needles are usually made of steel or stainless-steel, tempered so that the shaft of the needle can be bent without danger of it breaking. The size of hollow needles is measured in one of two ways. "Hypodermic" needles (Fig. 2) are given arbitrary numbers which denote the outside diameter and the length of the needle.

Number	Outside Diameter in millimetres	Length in inches
1	0·813	$1\frac{1}{2}$
2	0·711	$1\frac{5}{16}$
12	0·610	$1\frac{3}{16}$
14	0·610	$1\frac{3}{16}$
15	0·610	1
16	0·559	1
17	0·508	$\frac{15}{16}$
18	0·457	$\frac{3}{4}$
19	0·457	$\frac{11}{16}$
20	0·457	$\frac{5}{8}$

Needles No. 12–20 are used for giving subcutaneous injections, and for infiltrating local anæsthetic solution into the skin and subcutaneous tissues. Needles No. 1 and 2 may be used for intramuscular injections of aqueous solutions, for intravenous injections and for collecting blood from a vein.

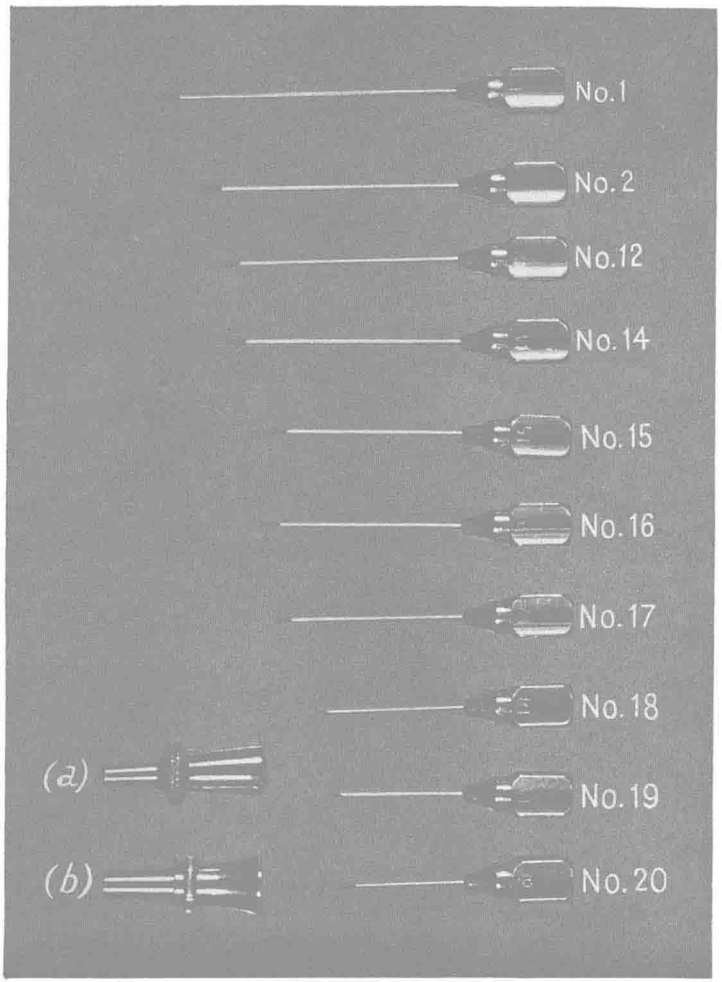

FIG. 2. Hypodermic needles, and adaptors for adapting (*a*) a syringe with a Luer nozzle to a needle with a Record mount, and (*b*) a Record syringe to a Luer mount. (*Actual size.*)

Needles suitable for intradermal, intramuscular or intravenous injections, and for aspiration are calibrated according to the standard wire gauge, which denotes only the diameter of the needle (Figs. 3 and 4).

Standard Wire Gauge	Outside Diameter in millimetres
17	1·422
18	1·219
19	1·016
20	0·914
21	0·813
22	0·711
23	0·610
24	0·559
25	0·508
26	0·457

These needles are available in various lengths, but as a rule the smaller the diameter the shorter the length. A 26-gauge needle, $\frac{3}{8}$ in. long, is used for intradermal injections and is commonly known as a Mantoux needle. Needles with a gauge of 18–22 and $1\frac{1}{2}$–2 in. long are suitable for intramuscular injections—those with a wider bore being used for viscid or oily fluids ; those with a narrower bore for aqueous solutions. They are also used for intravenous injections and taking samples of venous blood. The widest bore needles (gauges 17–19) are available in $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, and 4 in. lengths. The shorter lengths are used for giving or taking blood, and the longer lengths for aspirating pus or viscid fluid.

The Point of a Needle. The point of a needle may have a long or a short bevel. The former makes an angle of about 20 degrees with the shaft and is suitable for subcutaneous and intramuscular injections. The latter forms an angle of about 35 degrees with the shaft and is an advantage for intradermal and intravenous injections and for aspirations. The needle must be sharp, and new needles are not always so. The point should be examined to ensure that the extreme tip is not folded over. When drawn backwards between the fingers, the needle should be perfectly smooth.

The Mount. Mounts vary in shape, but are usually of two sizes —Luer or Record. Adaptors are available for adapting a syringe with a Record nozzle to a needle with a Luer mount, or a Luer nozzle to a Record mount (Fig. 2).

Sterilisation. In hospitals and clinics needles should be sterilised in a hot air oven or autoclave. They may be attached to a syringe or sterilised separately. The latter method allows the operator to choose a needle of appropriate length and diameter for his particular purpose. The point of the needle is protected

inside a length of glass-tubing and inserted into a test-tube which is sealed with cotton-wool (Fig. 1). In the absence of a hot air oven or autoclave, needles should be threaded through a piece of

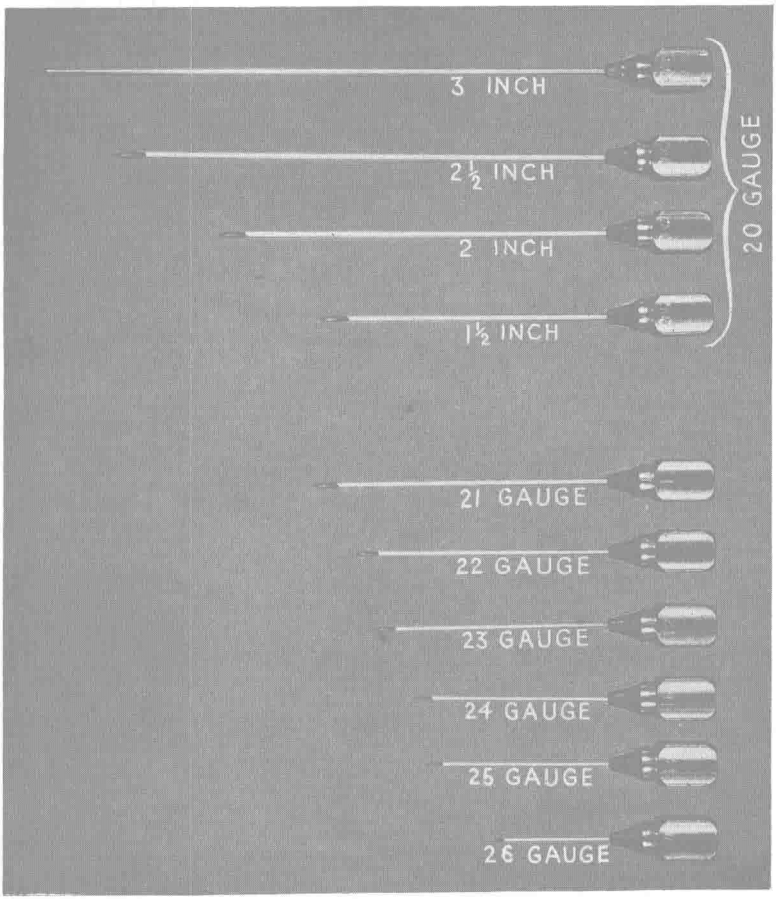

FIG. 3. Serum needles. (*Actual size.*)

lint to protect the point and sterilised by boiling. Immediately after use, a needle should be washed through with water, dried, and put away with its stilette in place.

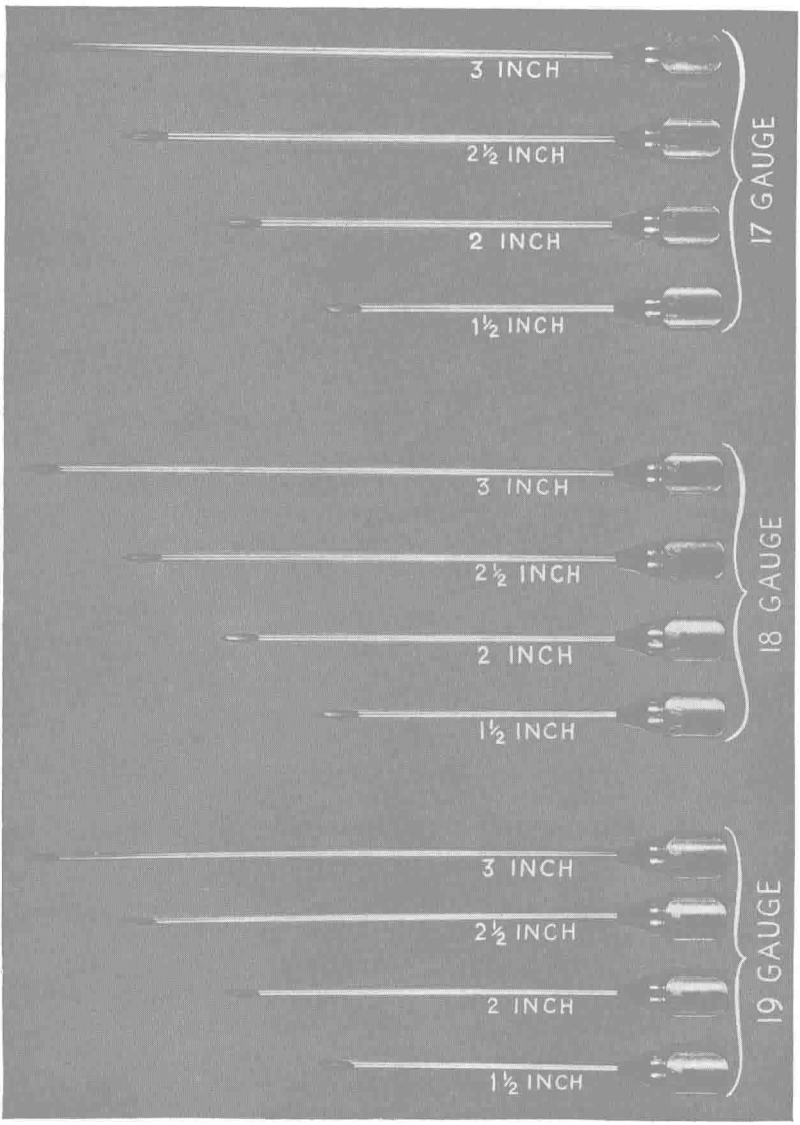

FIG. 4. Serum needles. (*Actual size.*)