A REVOLVER BULLET IN THE CAUDA EQUINA

By A. F. RUSHFORTH, M.B., F.R.C.S.

Registrar, Royal National Orthopaedic Hospital and Peace Memorial Hospital, Watford

WITH A NOTE ON THE BALLISTICS

By DR. A. KEITH MANT, M.B.(LOND.)

Department of Forensic Medicine, Guy's Hospital

Revolver bullet wounds inflicted with intent to kill are unusual in civil practice. In this case the patient survived injuries from two bullets directed at the trunk from close range. An interesting feature was the minor damage that resulted from one bullet which came to rest in the lumbar spinal theca.

History. On December 5, 1949, a young woman aged 22 years was in her parents' kitchen preparing the supper when suddenly a man entered and fired twice with a .45 calibre Colt revolver. One bullet hit the left arm just above the elbow and another entered the left loin. Her collie dog then attacked and drove off the assailant till wounded by the second of two further bullets.

On admission to the Peace Memorial Hospital, Watford, the patient was severely shocked. There was a wound of entry on the outer side of the left arm with some powder staining of the skin. There was no wound of exit and fragments of bullet could be felt under the skin on the inner aspect. The humerus was not fractured and there was no evidence of injury of the main nerves or vessels. The radiographs showed no damage of the humerus despite the fragmentation of the bullet (Fig. 1).

The second wound of entry was in the left lateral line just above the iliac crest, and again there was no wound of exit. The abdomen, however, was rigid and the right leg was paralysed. The antero-posterior radiograph of the abdomen showed that the bullet had fragmented part of the iliac crest (Fig. 2). It had then passed horizontally, medially and slightly backwards to strike the left posterior intervertebral joint between the fourth and fifth lumbar vertebrae and damage the lower pedicle. The bullet had thus been deflected upwards into the spinal canal, and came to rest opposite the body of the fourth lumbar vertebra with its long axis directed vertically. The lateral view showed that the bullet was just deep to the lamina of the fourth lumbar vertebra. The bullet track was clearly shown by bone and lead splinters;

one splinter of lead anterior and to the right of the bullet suggested that the bullet had struck the right wall of the spinal canal before coming to a stop.

Laparotomy (Mr. L. K. Watson). The abdomen was explored through a left paramedian incision and the bullet track was found to be retro-peritoneal. A small rent in the descending colon was sutured and the wound was closed. The two

FIG. 1.—Views of the left upper arm, showing the bullet fragmented but the humerus intact. Below, the two main fragments and the cartridge case.

FIG. 2.—Radiographs showing the track of the bullet and its final position in the spinal canal.

FIG. 3.—To show the area of loss of sensation to pin-prick on the right leg.

FIG. 4.—On the left the bullet is seen among the matted roots of the cauda equina. The black sutures are retracting the edges of the incision in the dura. The nerve roots to the left of the cavity appear intact, and were so from the neurological findings. On the right the bullet and the cavity it occupied are seen.

wounds of entry were excised and sutured, and the two main fragments of bullet in the left arm were removed through a counter-incision. It was considered advisable at that time to leave the other bullet *in situ*. A full course of penicillin was given. The next day the general condition of the patient was good. No signs of meningeal irritation or of peritonitis developed, and a normal bowel action occurred on the second day. There was retention of urine which was treated by intermittent catheterization. The general condition continued to improve and, the right leg remaining paralysed, the patient was referred to the Orthopaedic Department on December 12.

Examination at one week:

Left arm. The wounds were healing and the

loss of function suggested nothing worse than some muscle damage.

Trunk. Both incisions were healing soundly. The abdomen was generally tender but otherwise normal.

Right leg. There was a trace of wasting of the thigh and calf, with drop-foot and almost complete paralysis of the gluteal muscles.

Power. *At the hip joint*, gluteus maximus grade 1 (normal 5); ilio-psoas grade 3; abductors grade 1; adductors grade 3; *at the knee joint*, quadriceps grade 2; hamstrings grade 3; *below the knee*, calf muscle grade 2; flexors of toes grade 1; all other muscles grade 0.

Sensation (Fig. 3). There was loss to light

FIG. 5.—The type of toe-raising apparatus supplied. The short side steel to the calf fits into a flat socket in the heel, and there is a joint at the level of the ankle. The spring acts on a forward lug on the lower part of the side steel, and its tension can be easily adjusted.

touch and pinprick over the anterior aspect of the calf from just below the patella; this loss continued on to the dorsum of the foot and the toes. There was loss of joint sense in the ankle and toes.

It was decided that the bullet, possibly when ricocheting from the right side of the spinal canal, had damaged the right fourth and fifth lumbar nerve roots and, to a lesser extent, the first sacral nerve root. In view of the absence of meningeal irritation it was thought that the bullet might be extradural and that certainly there was no need for its immediate removal.

On the tenth day voluntary micturition commenced and was soon normal. After a month, when the patient's general health was excellent and all wounds were soundly healed, it was considered opportune to remove the bullet from the spinal canal.

Laminectomy (Mr. Valentine Logue, at the Royal National Orthopaedic Hospital). On January 6 the whole of the fourth lamina and the lower half of the third were removed. The dura was not pulsating and was tense; the bullet could be felt through it. The dura was then nicked and the bullet was seen to be in the sub-arachnoid space. The dural incision was enlarged up to 3 cm. and the bullet was exposed, surrounded by

FIG. 6.—Tracings from radiographs of a case of drop-foot treated by Lambrinudi's operation. Correction is obtained by removal of a large wedge, consisting of all the head and the lower part of the neck of the astragalus. Stability is obtained by seating the scaphoid on the remains of the neck of the astragalus. When bony fusion has occurred after three months in a walking plaster, drop-foot cannot occur at the ankle, as the astragalus is in the full equinus position with the os trigonum region close to the posterior tuberosity of the tibia.

adhesions and on the right side flanked by damaged nerve roots (Fig. 4). It was gently levered out of its bed, leaving a cavity containing some pus at the caudal end. On immediate examination this pus was found to contain no bacteria and on culture it proved sterile. The dural pulsation returned after removal of the bullet. No attempt was made to find the small separate fragment. The wound was closed in the usual way, 2 gm. of streptomycin were given daily for five days, and the patient made an uneventful recovery with no signs of meningeal irritation at any stage.

Progress. After a further six weeks the patient is ambulant and ready for discharge from hospital. There is minimal stiffness of the spine and a full range of active movement in the left arm. The motor and sensory loss in the right leg has not changed. For the drop-foot a toe-raising spring has been supplied (Fig. 5). In view of the appearances at operation, the muscle paralysis will almost certainly be permanent. The need for a toe-raising apparatus could be avoided by Lambrinudi's stabilization of the foot (Fig. 5), and if this operation is successfully performed later, the patient will have escaped with remarkably little loss of function.

Ballistics

Following the Geneva Agreement concerning expanding bullets, the .455 revolver firing a lead bullet, which was the general Service issue in the

1914-18 war, was replaced in this country by the .38 pistol firing copper or nickel-jacketed bullets. Consequently in Great Britain today most of the remaining .455 lead ammunition and the revolvers which fire it are preserved as souvenirs of the Great War and are over 30 years old. Usually neither the guns nor the ammunition have been well stored, with the result that the normal muzzle velocity of 600 ft. per sec. is greatly reduced, due to pitting of the barrels and deterioration of the propellant charge. Wounds caused by these neglected war trophies therefore bear no resemblance to the extensive and mutilating injuries inflicted by identical weapons in the 1914-18 war.

The case described above illustrates this clearly. Relatively little damage has been done, whereas if both weapon and ammunition had been in good condition the effect of two .455 missiles, each weighing over $\frac{1}{2}$ oz. and fired at a range of less than 6 ft., would have been devastating.

Acknowledgments

This case has been reported with the kind permission of Mr. L. K. Watson, Mr. K. I. Nissen, Mr. Valentine Logue and Detective-Inspector G. H. F. Dear of the Hertfordshire Constabulary. The photographs were taken by Mr. R. J. Whitley at the Institute of Orthopaedics.

BOOK REVIEWS

LAW RELATING TO HOSPITALS AND KINDRED INSTITUTIONS

By S. R. SPELLER, LL.B., Barrister at Law. 2nd Edition. Pp. xliii + 588. London: H. K. Lewis. 1948. 42s.

This second edition includes chapters on changes in the law affecting hospitals and those who serve in them brought about by the National Health Service Act. The author has also wisely included some of the more important statutory instruments and the superannuation regulations. It has been necessary to retain references to voluntary hospitals, nostalgic to some readers, but voluntary hospitals can still exist and some do. Doctors now under contract in the service at hospitals or institutions will find a clear description of the master-servant relationship, though it is still not certain what the position of the hospital is in the event of negligence on the part of the physician or surgeon under contract with it. The author rightly describes this as a complex subject. One addition to the previous work, which occupies 60 pages, deals with the law affecting hospitals and institutions for mental patients and mental defectives.

The book should be in the hands of all those actively engaged in hospital or institutional practice, medical, administrative or technical, not only for information on the legal consequences of their acts, but because in setting out the law affecting such questions the author has woven in much material that will assist in comprehending the National Health Service as a whole. An excellent index enables the enquirer to find his way to the point in question.

P.H.C.

AN INTRODUCTION TO CLINICAL SURGERY

By CHARLES F. M. SAINT, C.B.E., M.D., M.S., F.R.C.S. (Eng.), Hon. F.R.A.C.S., formerly

Professor of Surgery, University of Cape Town. 2nd Edition. Pp. viii + 384, with 373 illustrations. London: H. K. Lewis & Co., Ltd.; Cape Town: The Postgraduate Press, by Jutor & Co., Ltd. 1949. 45s.

'In the first edition,' said the South African regretfully, 'there were no illustrations.' Professor Saint has done his utmost in this second edition to repair the omission. The outstanding quality of his illustrations, their appositeness, clarity and variety lend great force to the wealth of the informative text.

The purpose and exact scope of the book are explained in his foreword. It is an 'introduction,' it is 'essentially clinical,' and it represents knowledge based on, and the result of, reasoned thinking about the subject. He deplores, and has not catered for the 'parrot' fashion of acquiring knowledge, and the reader will not find here facile lists of 'causes' or 'appearances,' but rather will be required to apply himself to a very full, though carefully paragraphed and headed consideration of the different aspects of clinical surgery.

The list of subjects is comprehensive and includes, apart from a regional survey of 'lumps and bumps,' chapters on the acute abdomen, peripheral vascular disease, calculi, jaundice, fractures and diseases of bones and joints.

The excellent illustrations may well beguile the student, but a careful study of the text reveals vast riches of material and opens up many fields of thought not easily to be had elsewhere, certainly not in the confines of so compact a book.

Professor Saint pays graceful tribute to his old teacher, Rutherford Morison, in whose footsteps he is a worthy follower.

The book is unreservedly recommended to students of surgery of all degree.

C.R.M.R.