

Abstracts of Papers read at a Symposium on Spinal Injuries held under the auspices of the Royal College of Surgeons, Edinburgh, on 7th and 8th June 1963.

ANATOMY AND PHYSIOLOGY

PROFESSOR GEORGE ROMANES (Edinburgh) gave the opening paper of the symposium on the blood vessels of the spinal cord, based on his own recent dissections, and fully illustrated with photographs and diagrams. He stressed the dependence of the spinal cord on longitudinal anastomotic vessels and gave details of the anterior and posterior spinal arteries in 18 spinal cords, together with the arrangement of feeding vessels to them, their intercommunications and the arrangement of the perforating arteries entering the spinal cord.

Dr. J. A. Simpson (Edinburgh) stated that the temporary loss of spinal cord function caudal to an acute transverse lesion is probably due to interruption of descending facilitatory pathways, especially reticulo-spinal and vestibulo-spinal. The return of reflex activity in exaggerated form with loss of local sign may also be attributed to loss of supraspinal inhibition. Alternative theories are unsatisfactory. Autonomic and visceral reflexes are affected in the same way as somatic reflexes, and viscerosomatic responses are released. Somato-visceral irradiation is not so well authenticated. The concept of a 'mass reflex' is unnecessary.

Either extension or flexion reflexes of the lower limbs may be dominant even in the completely decentralised cord. Both types may be evoked by supraspinal or peripheral stimuli but the posture of extension depends mainly on supraspinal influences whereas reflex flexion is mainly driven by peripheral stimulation so that the latter readily becomes dominant. The pyramidal tract may have an inhibitory role in the normal state, suppressing withdrawal reflexes more than postural and giving local sign to the former.

Intraspinal and extraspinal influences on the motoneurons are extremely complex and disturbances of interneurons may play a role in spasticity. These concepts are of practical importance in some new approaches to the symptomatic treatment of spasticity in the paraplegic patient.

Dr. Ernest Bors (Long Beach, California) described the features of phantom limbs in patients with spinal cord injury, and presented a hypothesis of an 'artificial synapse' at the proximal stump of the spinal cord. Phantom sensations of spinal cord injury occur in practically every patient and are of two types, surface and postural. Phantoms of upper extremities in tetraplegics are more vivid than those of lower extremities. Surface phantoms refer to nociceptive, and postural phantoms refer to proprioceptive sensations, including autonomic functions of micturition, defaecation and erection. Amputations following complete spinal cord injury do not change the spinal cord phantoms. Spinal cord injury following amputation may alter the nociceptive but not the postural component of an amputation phantom.

Dr. Ernest Bors in a comprehensive review of the anatomical and physiological aspects of urinary bladder function described micturition as a visceromotor movement which develops from its purely spinal reflex beginning to a willed process, complexly integrating smooth and striated muscle components at the highest level. The anatomical arrangement of detrusor fibres is such as to open mechanically the

smooth vesical neck sphincters, provided that the electromyographically demonstrable reciprocal reflexes are functioning.

The detrusor receives volitional impulses which must be associated with volitional impulses to striated muscles if physiologic micturition is to be the result.

The associated tonic activity of the striated muscles of the pelvic floor and of the abdomen is necessary for maintaining intra-abdominal pressure, and essential for micturition.

In micturition on desire, detrusor contraction precedes the fast pelvic floor relaxation and is associated with the slower vesical neck relaxation; in micturition on volition or command, pelvic floor relaxation seems to coincide with or even to precede the other events.

SURGICAL MANAGEMENT

Mr. L. Guttman (Stoke Mandeville) gave a survey of 396 traumatic paraplegics and quadriplegics following fracture and fracture-dislocation of the spine admitted during the last six years within the first 15 days after injury, 234 of them within the first 48 hours. One hundred and thirty patients showed additional injuries. The mortality rate was 7.6 per cent. and the majority of deaths occurred in cervical injuries mainly in patients over 40. Ten had laminectomies and seven open reduction and fixation by wiring and plating elsewhere before admission.

The author's method of immediate management of the fractured spine is postural reduction with a special support underneath the fracture and immobilisation on sorbo packs with regular turning. In cervical injuries skull traction with calipers is used when necessary, otherwise reduction is achieved by placing a small support underneath the fracture. By this method of postural reduction not only compression fractures, including burst fractures, can be kept safely in position and the compressed body re-expanded but the vast majority of fracture-dislocations can be reduced and consolidated. It is emphasised that this applies not only for stable but also for unstable fracture-dislocations.

With regard to the effect of postural reduction on the neurological symptoms, in over 60 per cent. definite improvement to a varying degree was found. Laminectomy as well as open reduction and metal plating or other methods are rejected and are only indicated in *very exceptional instances*.

Mr. F. W. Holdsworth (Sheffield) stressed the importance of determining the extent and type of damage to the nervous system, and of recognising the degree of deformity and stability of the vertebral injury, so that rational treatment may be applied. Dislocations of the cervical spine are unstable, and after skull traction has been applied and manipulation is carried out under anaesthesia, spontaneous fusion occurs if the vertebral body is fractured, but if it is not a posterior bone fusion or better an anterior bone graft is required. The majority of lumbo-dorsal injuries with severe neurological damage are very unstable, and internal fixation using plates bolted to the spinous processes, whilst spontaneous interbody fusion is occurring, is preferred.

Mr. Philip Harris (Edinburgh) discussed various neurosurgical aspects, including the indications for the surgical treatment of cervical injuries with special reference to the value of anterior decompression and bony fusion where a disc is ruptured or bony fragments are displaced into the spinal canal. In certain other patients internal posterior fixation with methyl methacrylate to stabilize the spine and to

permit early mobilisation of the patient is preferred. The significance of oedema of the cord in spinal injuries was mentioned, and treatment with intravenous mannitol or urea, was discussed. A new technique (Harris and Simpson) for the relief of intractable spasms in paraplegics was described in which the relevant anterior nerve roots or nerves are exposed and then painted with a phenol in glycerol solution.

Dr. H. Verbiest (Utrecht) related his personal experience of 13 patients who had one of three types of anterior decompression and anterior or/and interbody fusion operations for particular types of injury of the lower cervical spine. Cord compression was relieved and bony alignment restored.

Mr. D. W. Lamb (Edinburgh) described the management of the upper limbs in cervical cord injuries and observed that if there is serious functional loss, particularly in self-care activities, the choice of treatment lies between splints and gadgets and reconstructive surgery, in particular tendon transfer.

The results of tendon transfer will depend on available motor power and the technical perfection of the operation. It must be remembered that the results of surgery are permanent and unless chosen with care and experience the ultimate result may not be to the advantage of the patient. However the advantages of well chosen and well performed surgical procedures are greater than the permanent use of appliances. These appliances may well be of value in a patient who is helped and encouraged by the occupational-therapist but are usually put to much less use once the patient leaves hospital.

Mr. A. C. Buchan (Bangour Hospital, Broxburn) mentioned that pressure sores can almost always be avoided, and gave current views on their aetiology and prevention, and treatment. The early removal of slough and the opening of sub-cutaneous tracks were recommended. Some methods of skin closure were presented and included a discussion of the exposure technique of skin grafting, the 'en bloc' excision of deep sores and the use of continuous suction to prevent post-operative haematoma.

GENITO-URINARY ASPECTS

Mr. David Band (Edinburgh) described the early urological management of the neurogenic bladder. He considered that patients with acute spinal cord lesions could not derive full benefit from treatment in special spinal centres unless delay in admission was reduced to a minimum. Urological care was of paramount importance because the life span of this type of patient was directly proportional to the renal involvement, and all urological therapy must be aimed at the preservation of renal function. He considered that the simplest and most generally applicable method of avoiding over-distension of the bladder through the initial phase of traumatic paraplegia was by urethral catheter drainage. He presented the physiological and clinical basis for the use of continuous urethral catheter drainage, and described the application of the method, advocating the use of the Gibbon catheter. He detailed the methods adopted for the prevention of infection, including spraying the external genitalia with polybactrin, and irrigation of the urethra with a solution containing 1 per cent. neomycin, 1 per cent. bacitracin, and 0.4 per cent. polymyxin. The value of cystometry as a guide to the correct use of a catheter régime was illustrated and methods of training of the patient to regularised reflex bladder activity by the clock with spontaneous voiding were discussed.

Mr. Cosbie Ross (Liverpool) dealing with the later management of the bladder

in traumatic paraplegia, stressed that there must be efficient bladder voiding (either automatic, or by expression) with minimal infection. Certain patients, with complete retention or large residual urine, intractable infection, or ureteric reflux, hydronephrosis and renal failure, can be improved by bladder neck resection or by division of the external urethral sphincter muscle.

Forced diuresis, early mobility and efficient bladder voiding have largely eliminated calculus formation, and urethral fistula. Hydronephrosis, ureteric reflux, pyelonephritis and renal failure still present difficulties. Satisfactory voiding is essential and urinary infection must be minimal, and kept under control. A yearly check-up is necessary to ensure that hydronephrosis, renal deterioration and chronic retention or urine have not developed.

Sexual function in patients with spinal cord injury formed the subject of Dr. Bors' third paper, based on his personal interviews of 529 patients. There was an over-all incidence of erection (80 per cent.), ejaculation (15 per cent.), coitus (50 per cent.) and progeny (3.4 per cent.). Under pathological conditions, all of the sexual processes, depending on parasympathetics, sympathetics and somatics, can disintegrate. Sexual function is better with partial than with complete lesions. While erection is more frequent in patients with high lesions, ejaculation occurs more often in those with low lesions. Premature decline in potency is not uncommon in patients with spinal cord injuries. An orgasm or an equivalent is present as long as either autonomic or somatic pathways remain functioning; but acuity of orgasm seems to depend more on the somatic than on autonomic nerves. Procreation among male patients with cord or cauda equina lesions was somewhat more than three per cent. in this series. The lower or the more incomplete the injury the better is the prognosis for progeny. Female patients remain fertile; delivery is either normal or by caesarean section, though skeletal spasticity tends to inhibit contractions of the pregnant uterus.

Mr. L. Guttmann (Stoke Mandeville)—With regard to the initial management of the paralysed bladder, the author advocates non-interference by any instrumentation within the first 24 hours. Thereafter, intermittent catheterisation carried out by the Medical Officer in charge of the case and not by the nursing staff, let alone orderlies, using a non-touch technique is advocated which has proved far superior to the immediate management by the method of any kind of indwelling catheter.

Of 266 patients, 170 had sterile urine on discharge.

REHABILITATION AND RESETTLEMENT

Mr. W. G. Kerr (Edenhall Hospital, Musselburgh) reviewed rehabilitation of the motor system in paraplegics. Muscle power is developed to maximum capacity above the level of the lesion, and stiffness and spasm are reduced in the paralysed parts by daily passive movements. The aim in non-cervical cases is complete independence in the activities of daily living. The necessity for expert team work was stressed.

Dr. Antonio Maglio's (Rome) paper on Rehabilitation problems in paraplegia with amputation was accepted for publication in the proceedings of the symposium, though the author himself was unable to be present.

The purpose of Dr. Maglio's paper was to present the process of re-education for walking in patients suffering from paraplegia complicated by high amputation of the thigh. The importance of encouraging walking about in such patients was

stressed, not only from the psychological aspect, but also for the physiology of the paralytic area.

Dr. W. A. Murray (East Fortune) in discussing resettlement of the paraplegic mentioned the place for special aids, the attitude of physicians and surgeons and industrial rehabilitation. He also stressed the need for the instruction of the medical and nursing professions and those in ancillary professions in the present knowledge and skills of paraplegic management; also the necessity for careful follow-up and for research.

Dr. J. A. L. Naughton (Edinburgh) stated that there were as many different kinds of psychological readjustment as there were people who had to make it: but that it was important to remember that the human race, in general, was remarkably tough and adaptable in the face of real adversity, and, within limits, was stimulated by it.

The therapeutic moral was to encourage and exercise the capacity for independence and self-reliance as soon and as much as possible.

Mr. E. Jamieson (Edinburgh) and Mr. Phillip Harris described and demonstrated an electronic device for certain patients with severe physical disability, acknowledging the work of Mr. Maling, Stoke Mandeville Hospital. Innovations were a multi-hole coding unit, automatic presentation to the patient and radio control.

Dr. A. B. Rossier (Zurich), Dr. R. C. Schneider (Ann Arbor, U.S.A.) and Mrs. M. A. Thompson (Edenhall Hospital, Musselburgh) also took part in a Panel Discussion, which was chaired by Dr. Bors.