

ABSTRACTS OF SELECTED PAPERS

Myelomalacia following vertebral angiography with a femoral catheter, by Von D. Seitz and A. Hintze. *Fortschr. Röntgenstr.*, 125, 1: 59-62, 1976.

Cerebral angiography with femoral catheters in two patients was followed by an incomplete cervical transverse myelitis. The complications were thought to be due to high contrast concentration in the cervical spinal vessels because of hypoplasia of the vertebral artery, and to contrast injection into the thyrocervical trunk.

The mechanism of spinal cord cavitation following spinal cord transection. Part 1: A correlated histochemical study, by Chun C. Kao and Louis W. Chang. *J. Neurosurgery*, 46, 2: 197-209, February 1977.

Transection of a spinal cord is followed by massive accumulation of lysosomes and release of lysosomal hydrolases within both the rostral and the caudal spinal cord stumps. The lysosomal activity begins at 3 hours after cord transection, maintains its peak for 3 to 7 days, and declines at 14 days after transection. The process is associated with autolysis of the cord stumps and subsequent cavitation. Lysosomal accumulation is greatly diminished, and, paradoxically, superior wound healing is the result at the stumps of a 5-mm segment of isolated spinal cord produced by double cord transection.

Fetal spinal-cord injury secondary to hyperextension of the neck: no effect of caesarean section, by Kihei Maekawa, Takuro Masaki, Yoshiyuki Kokubun. *Develop. Med. Child Neurol.* 18: 229-238, 1976.

A 24-month-old Japanese girl is reported, who had upper spinal cord injury secondary to foetal hyperextension of the neck in breech presentation. She was first noted to be in this position 10 days before the expected date of birth and was delivered by caesarean section.

Recovery from experimental paraplegia after levodopa administration, by P. Popovic, V. Popovic and R. Schaffer. *Acta Neurochirurgica*, 35, 1-3: 141-147, 1976.

In decompression sickness and during some surgical procedures, air emboli that form sometimes cause serious damage if the gas bubbles find their way to the vital organs. Paralysis of the spinal cord is one of the most serious manifestations induced by air emboli. Exposure to compression chambers is effective in air emboli treatment, but availability of chambers is inadequate and the treatment is lengthy. Until now there has been no fully effective injectable agent that can remedy the damage caused by air embolisation.

In this work levodopa was chosen as an injectable drug that might help to improve recovery from experimental paraplegia because of the reported effects of levodopa on muscle tone, spasticity and locomotion. To induce air emboli, the descending aorta of rats was chronically cannulated. Two weeks later, after full recovery from surgery, air was injected through the permanently implanted cannula into unanaesthetised rats (0.35 ml of air per 100 g, during 4 seconds). The paraplegia (paralysis of both hind legs) was manifested 2-10 minutes later. Only animals that had total paraplegia, without any sensation, were used in the experiments. Levodopa was administered 2 minutes after paraplegia was established. The levodopa treatment was repeated each day during 1 week. After 6 days, ten levodopa treated (intra-arterially) animals in a group of 12 and six levodopa treated (intraperitoneally) animals in a group of eight recovered completely from paraplegia. In control groups only three from 13 (untreated), or two from 12 (solvent administration) animals recovered from paraplegia.

Effect of acute spinal cord compression injury on regional spinal cord blood flow in primates, by Alan N. Sandler and Charles H. Tator. *Journal of Neurosurgery*, 45, 6: 660-676, December 1976.

Spinal cord blood flow (SCBF) was measured in 24 rhesus monkeys after injury to the cord produced by the inflatable circumferential extradural cuff technique. Measurement of regional blood flow in the white and grey matter of the cord in areas of 0.1 sq mm was achieved with the ^{14}C -antipyrine autoradiographic technique and a scanning microscope photometer. After moderate cord injury (400 mm Hg pressure in the cuff maintained for 5 minutes), which produced paraplegia in 50 per cent of animals and moderate to severe paresis in the other 50 per cent, mean white matter SCBF was significantly decreased for up to 1 hour. White matter blood flow then rose to normal levels by 6 hours post-trauma and was significantly increased by 24 hours post-trauma. Grey matter SCBF was significantly decreased for the entire 24-hour period post-trauma. After severe cord injury (150 mm Hg pressure in the cuff maintained for 3 hours), which produced total paraplegia in almost all animals, SCBF in white and grey matter was reduced to extremely low levels for 24 hours post-trauma. In addition, focal decreases in SCBF were seen in white and grey matter for considerable distances proximal and distal to the injury site. It is concluded that acute compression injury of the spinal cord is associated with long-lasting ischaemia in the cord that increases in severity with the degree of injury.

'Standardised' spinal cord trauma: biochemical parameters and lesion volume, by George J. Dohrmann and Manohar M. Panjabi, *Surgical Neurology*, 6, 5, November 1976.

The T5-6 level of the feline spinal cord was traumatised by the weight-dropping technique. The following '400 g-cm' trauma groups were studied: (I) 5 g \times 80 cm; (II) 10 g \times 40 cm; (III) 20 g \times 20 cm; (IV) 40 g \times 10 cm; and (V) 80 g \times 5 cm. It was found that the lesion volume was different in each of the groups even though all had a '400 g-cm' injury. In Groups I through IV the deformation velocity, energy and lesion volume were related to the height in a hyperbolic manner. In all groups a linear relationship was noted between lesion volume and impulse while a sigmoid-shaped non-linear relationship between lesion volume and energy was present. The amount of energy transferred to the spinal cord was dependent upon factors such as mass, height, impounder mass and velocity. Energy absorbed by the spinal cord in Group IV was approximately 100 times that in Group I.

Plasma catecholamines during paroxysmal neurogenic hypertension in quadriplegic man, by C. J. Mathias, N. J. Christensen, J. L. Corbett, H. L. Frankel and J. M. K. Spalding. *Clinical Research*, 39, 2: 204-208, August 1976.

Blood pressure, heart rate, and plasma catecholamine levels were measured in 16 quadriplegic subjects with physiologically complete cervical spinal cord transections above the level of the sympathetic outflow, and also in 15 normal subjects (controls). In the quadriplegics the average resting blood pressure was 107/59 (mean, 75) mm Hg, heart rate was 65 beats/min, and plasma norepinephrine (NE) and epinephrine (E) levels were 0.05 and 0.005 ng/ml, respectively. In the controls average resting blood pressure was 117/79 (mean, 92) mm Hg, heart rate was 61 beats/min, and resting plasma NE and E levels were 0.20 and 0.06 ng/ml, respectively. Resting blood pressure and plasma NE and E levels were significantly lower in the quadriplegics ($P < 0.01$, < 0.001 , < 0.001 , and < 0.001 , < 0.001 , respectively) than in the controls. In the quadriplegics, neurogenic hypertension was induced by bladder and muscle stimulation. This resulted in a marked elevation of both systolic and diastolic blood pressure (from an average of 109/60 (mean, 75) to 168/87 (mean, 114) mm Hg) as a result of uninhibited sympathetic nervous

activity through the isolated spinal cord. Plasma NE consistently rose, from an average of 0.05 to 0.16 ng/ml ($P < 0.001$). There was a significant linear relationship between plasma NE and mean blood pressure ($P < 0.001$). In the quadriplegics infusion of 1-norepinephrine to raise the blood pressure to comparable levels (from 105/58 (mean, 74) to 183/93 (mean, 123) mm Hg) resulted in plasma NE levels approximately 21 times higher than during muscle and bladder stimulation. It is possible that the lower resting arterial blood pressure and plasma NE and E levels in the quadriplegics in comparison to normal subjects may reflect diminished resting sympathetic nervous activity. The rise in blood pressure following increased sympathetic nervous activity was accompanied by an elevation in plasma NE. The hypertension was not secondary to the rise in plasma NE. Plasma NE in these subjects appears to be a reliable index of prevailing sympathetic nervous activity.

Electrophysiological technique for evaluating lesions of the conus medullaris and cauda equina, by Gaylan L. Rockswold, William E. Bradley, Gerald W. Timm and Shelley N. Chou. *J. Neurosurg.* 45: 3, September 1976.

The authors describe the use of evoked electromyographic responses recorded in the anal sphincter induced by stimulation of the bladder wall and urethra in evaluating lesions of the conus medullaris and cauda equina in 110 patients. This reflex response took effect by way of the pelvic nerves and cauda equina to the sacral cord where the pudendal nerve nucleus was activated, resulting in a contraction of the external anal sphincter. Various lesions along this pathway have been shown to produce either increased latencies and depressed response depending on the extent of the lesion. The correlation of results of this technique with clinical, myelographic, and operative findings indicate it to be a useful clinical tool.

Intermittent catheterisation and vesical defenses, by Frank Hinman. *Journal of Urology*, 117, 1: 57-60, January 1977.

The effectiveness of intermittent catheterisation in eradicating bacteriuria in patients requiring catheterisation for inadequate voiding was subjected to a mathematical analysis to establish its theoretical basis. It can be shown that, at one extreme, with 6 ml, urine remaining in the bladder (assuming reasonable hydration), catheterisation must be done at least every 2 to 2½ hours to limit bacteriuria. In contrast, if as little as 0.5 ml urine is left behind, catheterisation may be done every 4 to 5 hours to achieve the same result. Moreover, from the graphic depiction of the calculation it is seen that a reduction in the intervals between catheterisation has a much greater effect than an increase in the urinary output in the reduction of the bacterial count.

Upon applying the equation relating frequency of catheterisation and urine output to residual urine in a clinical programme of intermittent catheterisation, we found that the usual (convenient) schedule often resulted in showing that an unattainably small volume of urine would have to be left in the bladder. Actual measurement of residual urine by the modified phenolsulfonphthalein test provides the data needed to design a programme of intermittent catheterisation for each patient that will lead to urinary sterility.

Electrophysiological techniques for the study of urethral and vesical innervation, by J. T. Andersen, W. E. Bradley and G. W. Timm. *Scand. J. Urol. Nephrol.* 10, 3: 189-194, 1976.

A new electrophysiological technique for the study of urethral and vesical innervation is reported. The method gives valuable information on the structural integrity and function of two of the reflex arcs involved in micturition. Normal and pathological patterns are described, illustrating the diagnostic value of the method in the assessment of neurogenic disturbances of bladder and urethral function.

Urethral pressure profile during the spinal shock stage in man: a preliminary report, by S. A. Awad, S. R. Bryniak, J. W. Downie and D. A. S. Twiddy. *Journal of Urology*, **117**, 1: 91-93, January 1977.

The functional state of the proximal urethra in the spinal shock stage in man is not fully understood. We studied patients with spinal cord injuries during spinal shock and found that the urethral pressure profile had a normal configuration, the peak profile pressure increased with bladder filling and phentolamine (10 mg intravenously) reduced the peak pressure, with empty and full bladders.

Measurement of intravesical and rectal pressures simultaneously with electromyography of anal sphincter in children with myelomeningocele, by J. D. Van Gool, A. L. A. De Ridder, R. H. Kuijten, R. A. M. G. Donckerwo'cke and H. A. Tiddens. *Develop. Med. Child Neurol*, **18**: 287-301, 1976.

This paper reports a technique for simultaneous measurement of intravesical pressure, intra-abdominal pressure, electromyographic activity of the external anal sphincter and urinary flow. Using this technique during filling of the bladder and during micturition in 38 children with myelomeningocele and neurogenic bladder disturbance, it was possible to identify four main types of bladder dysfunction in these children. Once the type of bladder dysfunction is established for each child, adequate management can be planned far in advance of the detection of inherent upper urinary tract damage. This is particularly important in children with upper somatomotor neuron lesions of bladder innervation in which detrusor-sphincter dyssynergia may be present; thus dyssynergia always causes some degree of obstruction at the level of the external urethral sphincter and is a constant threat to renal function.

Neuromuscular dysfunction of the lower urinary tract in patients with lesions of the cauda equina and conus medullaris, by William E. Bradley and Jens T. Andersen. *Journal of Urology*, **116**, 5: 620-621, November 1976.

Bladder and urethral function was studied in 21 patients with lesions of the cauda equina or conus medullaris using gas cystometry, integrated sphincter electromyography, uroflowmetry and computer-assisted measurement of detrusor and delayed reflex-evoked potentials from stimulation of the detrusor muscle and urethra were the most consistent indicators of lesions of the conus medullaris and/or cauda equina. A terminology based on detrusor reflex abnormalities rather than the ice-water test is suggested.

Muscle fiber composition in patients with traumatic cord lesion, by Gunnar Grimby, Catarina Broberg, Iga Krotkiewska, Marcin Krotkiewski. *Scand. J. Rehab med*, **8**, 1: 37-42, 1976.

Muscle fibre composition and oxidative and glycolytic enzymatic activity have been studied with complete traumatic transection of the spinal cord and spastic paralysis of the lower extremities. Muscle samples were taken by means of needle biopsy from the vastus lateralis, gastrocnemius, and soleus muscles. Biopsies were also taken for comparison from the deltoid muscle. Fibres staining darkly for alkaline stable myofibrillar ATP-ase (type II) dominated or were the only fibres identified in the paralysed muscles. The deltoid muscles of the same patients had a rather even mixture of type I and II fibres. Staining pattern was reversed after acid preincubation (pH 4.3). Mean diameters in the paralysed muscles were reduced for both fibre types. All fibres stained relatively weakly for NADH-diaphorase. Succinyldehydrogenase activity was low and phosphofructokinase activity usually moderately reduced. The findings imply that neuronal influence on the muscular fibres had led to a change in the staining characteristics of the muscle fibres. Such a change might indicate altered contractile characteristics, though the detailed nature of the observed findings is still unclear.