entitled *Charles Scott Sherrington: An appraisal*, 'In the end, understanding of the principles which physiology is now beginning to unravel must also become useful in clinical work', will come true.

ZUSAMMENFASSUNG

Das Problem des Muskeltonus und seine Messung wird diskutiert. Die Wichtigkeit, den ganzen Patienten zu studieren, wird betont.

Eine Möglickeit der Tonusmessung ist die Bestimmung der Aktionsgeschwindigkeit und Ausdauerzunahme.

RÉSUMÉ

Le problème du tonus musculaire et de sa mesure est discuté. Il est important d'étudier le malade dans son ensemble.

La vitesse de l'action et l'augmentation de l'endurance serait utiles à étudier.

SUMMARY

The problem of muscle tone and its measurement is discussed. The importance of studying the patient as a whole subject is stressed. A possibility of muscle tone measurement is probably the measurement of the speed of an action and an increase in educrane.

REFERENCES

BERNSTEIN, N. (1967). *The Co-ordination and Regulation of Movements.* Pergamon Press.
BRONDGEEST, P. Q. (1860). *Disquisitiones de Tonus Musculorum.* Thesis. Utrecht.
GRANIT, R. (1966). *Charles Scott Sherrington: An Appraisal.* Edinburgh: Nelson.
GRANIT, R., KAADA, B. R. (1953). Influence of stimulation of central nervous structures on muscle spindles in cat. *Acta Physiologica Scandinavica*, **27**, 130.
KUGELBERG, E., EKLUND, K. & GRIMBY, L. (1960). *Brain*, **83**, 394.
KUGELBERG, E. & HAGBARTH, K. E. (1958). Spinal mechanism of the abdominal and erector spinae skin reflexes. *Brain*, **58**, 290.
KENNEY, W. E. & HEABERLIN, P. C. (1962). *J.R.P.T. Clinical Orthopaedics*, No. 24.
POOL, G. M. (1965). *Int. J. Paraplegia*, **3**, 188; (1966) **4**, 142.

MANAGEMENT OF PATIENTS WITH MYELOMENINGOCELE

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THIS study is concerned with the neuro-orthopaedic study, urological management and educational orientation of 74 patients with myelomeningocele. The ages of the patients studied range from 2 to 25 years (50 per cent. from 7 to 14).

The neuro-orthopaedic study includes 56 patients who have been divided into 5 groups according to the level of the lesions as follows:

Group 1: above T12	2 patients
Group 2: L1-L2	17 patients
Group 3: L3-L4	24 patients
Group 4: L5-S1	12 patients
Group 5: S2-S3	1 patient

Patients were divided into groups on the basis of retained muscle strength. 'Fair' strength was considered present if motion could be made in the gravity-resisted position, even though range of motion was not complete.

The last group consisted of a patient who had partial control of micturation. In all the others there was no voluntary control.

Causes of Deformities

Analysis of the patients revealed several primary and secondary factors in the development of deformities: (1) gravity, (2) muscular imbalance, (3) fibrosis (capsules, muscles, fasciae), (4) bone deformities (coxa valga, anteversion of the femoral neck, acetabulum deformity, scoliosis, kyphosis, lordosis).

1. Gravity specially applies to the group L3-L4 since the presence of quadriceps helped the patients to stand up but at the same time a body weight was a contributory factor for dislocation of the hip and lordosis as mechanical compensation.

It has been described that the lack of gravity increases the coxa valga and the anteversion of femoral neck (Swinyard, 1965).

2. The muscular paralysis resulted in antagonist's contracture; the major imbalance appeared between the flexion (L2) and the extension (L5-S1) and, to a lesser degree, due to metamere proximity between adduction (L3) and abduction (L4).

Adduction deformity became dangerous to the coxo-femoral stability due to the flexion component.

In one case we observed good gluteous maximus function but paralysis of the extensors and peroneals of the leg.

3. Fibrosis was observed in muscles, capsules of the joints and fasciae.

In a few cases we found deformities which were somewhat similar to those seen in clubfoot and arthogriposis.

4. Primary or secondary bone deformity was more frequent when there was more biomechanical precision and higher embryological complexity.

Twenty-eight per cent. of the patients suffered from dislocations or subluxations of the hip. They were distributed according to the motor levels.

Group L1-L2: 5
Group L3-L4: 9
Group L5-S1: 1
Group S2-S3: 1

Scoliosis was observed in 9 patients.

Group T12: 1
Group L1-L2: 2
Group L3-L4: 5
Group L5-S1: 1

None of the patients underwent surgery because of scoliosis.

Use of Braces in Accordance with Motor Level

Group T12. In this group we have always avoided a corset.

Group L1-L2. We generally prescribed long braces and crutches. When we found a severe adduction contracture, subluxation or rotation of the hip, we added a pelvic belt without ischial seat.

Group L3-L4. When the patient had a good quadriceps we prescribed crutches and a pair of correcting insoles with medial longitudinal arch hypercorrection and high-top shoes to stabilise the ankle and avoid drop foot.

Group L5-S1. These had good gluteus maximus and medius but weakness of the triceps surae which avoids the correct push-off of the foot. No braces were prescribed in this group.

Group S2-S3. Walking was normal, partial paralysis was observed in the striated perineal muscles.

Type of Surgery Performed to Correct Alignment and Deformities in 56 Patients

Physical therapy, braces and surgery were the methods of treatment which were used. They were so arranged that either the clinical or surgical approach would take precedence in time depending on the needs of the patients. For example, surgery would be done first if the deformity were so great as to preclude proper use of braces.

We performed 75 orthopaedics procedures: in L1-L2 group 14 procedures, in L3-L4 group 47 procedures and in L5-S1 group 14 procedures.

These figures show that there was an average of one operation for each patient with exception of the L3-L4 group when there was an average of two surgical procedures for each patient: 54 procedures were done on soft tissue.

Pressure Ulcers

The most typical of the pressure ulcers was on the internal malleoli produced by ballant feet, using high-top shoes or short braces without a correcting insole.

Urological Disturbances in 56 Patients

Incontinence was found as permanent dribbling, voiding every few minutes or every few hours. Most commonly we found patients with the first and second type of bladder dysfunction. The patients and their families were educated to regulate the intake of fluid and bladder evacuation according to the type of incontinence, sex and the need of external devices. In a few cases a temporary indwelling catheter was necessary. The residual urine was less than 20 cc. in 57 per cent. of the cases; between 20 to 100 cc. in 12 per cent. The bladder capacity was classified according to excretory urography, cystography and cystometry. We called capacity grade 1 a volume of less than 150 cc., grade 2 between 150 cc. and 300 cc. and grade 3 a capacity over 300 cc.; 46 per cent. of the patients had volumes less than 150 cc. and two cases over 300 cc. Among the 56 patients, 50 per cent had trabeculation of the bladder, 66 per cent. of which had urinary tract dilatation. Reflux into the upper urinary tract was not included. Cystometry showed autonomous bladder of myogenic type without inhibited contractions of the supranuclear type. Micturation around the catheter was in general the result of an increase of the intravesical pressure due to the passage of the fluid

when we performed retrograde cystometry but not because of the active contraction of the detrusor. Bladder stones were found in only one case.

Urological Surgery

Between 1963 and 1964, following reports on cutaneous vesicostomy, we performed, on a group of 6 patients with good size bladder without ureteral reflux, this operation with the Lapides and Blockson techniques.

Our results were poor. We called attention to this fact as early as 1965 in several papers (Carreño *et al.*, 1965-1966; Bernstein-Hahn *et al.*, 1966) as well as those of Guttmann and Frankel, 1966; Bors, 1963; Comarr, 1963; Ebel, 1963. No further operations of this type were performed.

The main problems encountered with cutaneous vesicostomy were continuous urinary incontinence, mycosis and strictures of bladder stoma. In four cases to keep then patent required continuous dilatations of the stoma. In three cases there were difficulties to adapt the cystostomy bags. In all cases urinary infection remained unchanged. Two patients reverted to catheter drainage, two patients required secondary Bricker procedures with clinical improvement. One patient was lost for follow-up and only one girl remained with the cutaneous vesicostomy for 6 years, with persistent residual urine and urinary infection.

Six years ago 9 patients with different degrees of hydronephrosis and reflux were submitted to ileal bladder (Bricker, 1950; Smith, 1964). Three of them died because of renal complications, six are very well. A few years ago four teenagers with severe dilated ureters had Lapides-type butterfly ureterostomy, which were remarkably well tolerated. In another patient, 8 years old, we performed a Cordonnier type of ileocystostomy with poor result.

Education

More than 60 per cent. of approximately 200 patients observed in this Institute had difficulties in studying in regular schools, although they showed good mental capacity. Therefore we have begun building an elementary school in the grounds of the Institute, which will provide vocational training very early. The capacity of this school will be for 70 in-patients and 40 out-patients.

Summary

1. Neuro-orthopaedic, urological and educational evaluation of 74 patients is reported.

2. Limb deformity was more frequent in patients with L3-L4 motor level.

3. Severe fibrosis rather than muscular imbalance provides the deforming force in a number of cases.

4. In 46 per cent. of the patients the bladder had a capacity of less than 150 cc., 50 per cent. had trabeculations, 66 per cent. had upper urinary tract dilatation.

5. In 57 per cent. of the cases the bladder had a residual urine less than 20 cc.

6. In another series of patients followed up for several years 20 urinary diversions were done in 18 patients.

In view of these series we advise Bricker type of ileal bladder unless huge dilated ureters are present, in which case Lapides butterfly ureterostomy provides the best answer to the urinary problems in myelomeningocele patients.

7. Six patients had cutaneous vesicostomy with bad results.

8. In approximately 200 patients tested in our institute about 60 per cent. would benefit from schooling and vocational guidance. Eight months ago the building of a home-school was started in order to fulfil this need. The cost has been calculated to be 700,000 American dollars.

Résumé

1. L'aspect neurologique, orthopédique, urologique et la scolarité de 72 malades sont rapportés.

Les difformités des membres inférieurs étaient plus fréquentes dans les lésions motrices L3-L4.

3. Une fibrose plutôt qu'un déséquilibre musculaire a été retrouvée comme étant la cause principale déformante.

4. 46 per cent. des malades avec une incapacité vésicale de moins de 150 ml, 50 per cent. avaient présenté des trabeculations, 66 per cent. des dilatations du haut appareil urinaire.

5. 57 per cent. avaient un résidu de moins de 20 per cent.

6. Dans d'autres séries de malades qui ont été suivis pendant plusieurs années, 20 dérivations urinaires ont été effectuées sur 18 malades. La vessie de Bricker ou iléal a été la méthode de choix, sauf dans le cas d'uretère dilaté où l'urétérostomie en papillon du type Lapides est indiquée.

7. 6 malades ont eu une vesicostomie cutanée avec des résultats médiocres.

8. Sur les 200 malades testés dans notre Institut, 60 per cent bénéficieraient d'une scolarité et d'une orientation professionnelle. Il y a 8 mois la construction d'un internat a été commencée, dont le coût se situe aux environs de 700,000 dollars.

Zusammenfassung

1. Neuro-orthopaedische, urologische und erzicherische Aspekte werden an 74 Patienten berichtet.

2. Gliederdeformitäten waren häufiger bei Patienten mit L3-L4 Höhe.

3. In einer gewissen Zahl von Patienten Fibrosis stellt eher als muskuläre Dysfunktion die deformierende Kraft dar.

4. In 46 per cent. der Patienten war Blasenkapazität geringer als 150 ccs, 50 per cent. hatten Trabekulationen, 66 per cent. hatten eine Dilatation der oberen Harnwege.

5. In 57 per cent. der Fälle war der Residualharn geringer als 20 ccs.

6. In 18 Patienten, verfolgt über vesrchiedene Jahre, wurden 20 Diversionverfahren ausgeführt. Bricker's ileal Blase wird empfohlen, aber bei enorm dilatierten Ureteren in myelomeningocele Patienten hat sich die Schmetterling—Ureterostomy nach Lapides am besten bewährt.

7. Schlechte Resultate ergab die 'cutaneous vesicostomy' nach Lapides.

8. 60 per cent. von ungefähr 200 Patienten könnten von Schulerziehung und industriellem Training profitieren. Vor 8 Monaten wurde mit dem Bau einer eigenen Schule begonnen, deren Kosten auf 700,000 Am-Dollar geschätzt wurde.

REFERENCES

BERNSTEIN-HAHN, L., CIBEIRA, J. B. & ZONZINI, J. (1966). Follow-up report on Lapides tubeless vesicostomy. International Medical Society of Paraplegia. Stoke Mandeville: Julio.

BORS, E. (1963). Proc. Clin. Spinal Cord Conf., V.A. Hosp., Hines, U.S.A., p. 94.

BRICKER, E. M. (1950). Bladder substitution after pelvic evisceration. *Surg. Clin. N. Amer.*, **30,** 1511.

CARREÑO, O., BERNSTEIN-HAHN, L., CIBEIRA, J. B., TURTELA, F. & ALONSO, J. (1965). Derivaciones urinarias en pacientes con mielomeningocele. *Actas IX Congreso Americano de Urologia*, Tomo II, 262-265.

CARREÑO, O., BERNSTEIN-HAHN, L. & ZONZINI, J. (1966). Citostomia tubulada según técnica de Lapides. XV Congreso del International College of Surgeons, Mexico. Sep. 27.

COMARR, E. (1963). Proc. Clin. Spinal Cord. Conf. V.A. Hosp., Hines, U.S.A., p. 94.

EBEL, A. (1963). Proc. Clin. Spinal Cord Conf. V.A. Hosp., Hines, U.S.A., p. 94.

GUTTMANN, L. & FRANKEL, H. (1966). The value of intermittent catheterisation in the early management of traumatic paraplegia and tetraplegia. *Paraplegia*, **4,** No. 2, August.

SMITH, E. D. (1964). Ileo cutaneous ureterostomy in children. *Aust. N.Z. J. Surg.*, **33,** 169.

SWINYARD, CHESTER. (1965). Comprehensive care of the child with Spina Bifida manifiesta. New York University.

Discussion

DR. MARY PRICE (*U.S.A.*). I would like to enquire of Dr. Cibeira in what percentage of his ilial diversion patients did he achieve sterility of urine.

DR. J. CIBEIRA (*Argentine*). In 45 patients the urinary tract dilatation became better but the urine became sterile in only 35 patients and the rest were no worse.

THE NEUROVEGETATIVE SYNDROME OF VESICAL DISTENSION IN PARAPLEGICS. PREVENTION AND THERAPY

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UNDOUBTEDLY one of the most distressing complications of cord lesions is the neurovegetative syndrome from vesical distension. The subject is by no means a new one: of the writers who have devoted special attention to it I would recall Guttmann and Whitteridge, Munro, Maloudeau, Gilliat, Thompson and Witham. Today, therefore, I merely wish to give a brief summing-up, and in particular to give an outline of the therapeutic methods adopted at the Milan Traumatologic Center.

I would recall briefly that the main characteristics of the syndrome are as follows:

1. It is a syndrome that is noted exclusively in lesions situated at a high level of the cord and above all in tetraplegics.

2. Its clinical manifestations occur following distention of the vesical wall, either due to spontaneous filling with urine from the ureters or to the introduction