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The Medical Journal of Malaya

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Editorial

The commission of Inquiry into the Health Services

by A.A. Sandosham

THE MEDICAL AND HEALTH SERVICES of the country have been undergoing rapid changes since it gained independence in 1957. The Malaysian Medical Association was concerned with the piecemeal development that was taking place and the lack of overall planning and philosophy. The Association felt the need for a Commission of Inquiry to study the future needs taking into account the financial and other resources of the country and make recommendations as to the sort of health service we should aim at achieving and phase the development programme. We did not ourselves feel competent to tackle this problem, most of our members lacking this overall knowledge of health services in other countries and the time necessary to study this complex question in detail. Nevertheless, the Council had set up a Committee composed of Dato (Dr.) Lim Kee Jin (Chairman), Dato (Dr.) Keshmahinder Singh, Professor Tan Eng Seong and Professor A.A. Sandosham, Dr. Syed Mahmood bin Syed Hussain, Dr. Chan Jee Swee and Dr. Chin Kui Sang to study the problem as the Ministry of Health did not appear to favour the idea of bringing out a Commission of Inquiry.

We were, therefore, taken by surprise but delighted to learn of the presence in our midst of two Colombo Plan advisers to the Government of Malaysia, namely Dr. H.W. Garlick, Professor of Medicine at Monash University, and Dr. R.C. Webb, Commonwealth Director of Health for Victoria, to tackle this very problem. These two advisers, during a 3-month period early this year, travelled extensively in the country interviewing medical men and administrators gathering information at firsthand to supplement the facts and figures provided by the Ministry of Health.

The Commission, in the course of its stay in Malaysia, met members of the MMA and its Council and representatives of the Private Pracitioners' Associations. Nevertheless, the MMA was requested by the Commission to submit a memorandum on its views, especially in regard to certain questions they had submitted to us. This posed a

big problem to the MMA as it was given too little time to consult members and as it would be next to impossible to express views on certain questions which would meet with the unanimous approval of all sectors of the medical profession. The aforementioned Committee of MMA was hastily summoned which, with the cooption of a few more, produced a memorandum after 4 days' deliberation. It was made clear in the memorandum that although it had the approval of the Executive Committee of MMA, the Council as a whole had not met to discuss it and that the members have not had the opportunity to see it. It was made known through the MMA Newsletter that individual members or groups could present their views directly to the Commission on any matters relating to the future of the health services of the country.

The memorandum attempts to arrive at broad areas of agreement but where there might be differing points of view, both have been presented without prejudice so that the Commission could formulate its own recommendations. A number of questions have been put to us but in addition we have expressed our views on related problems. Among the questions tackled were, (1) if there should be a dichotomy of technical or medical administrators and non-medical administrators giving more autonomy to the states and the large hospitals, (2) measures to be taken to remedy the uneven distribution of medical manpower in the urban and rural areas, (3) should medical practitioners in private practice be given the oportunity to work part-time in Government hospitals and health centres, (4) should medical practitioners in Government service in certain rural areas be afforded a right of private practice outside normal working hours to make these areas more attractive, and (6) how to increase the production or importation of medical practitioners.

In addition to answering the questions submitted to us by the Commission, the memorandum attempts to tackle a few other topics, such as hospitals, training, research and methods of recruitment and retention of medical officers in Government service. It is hoped that the Commission found the memorandum, although hastily drawn up and not comprehensive, of some assistance in their deliberations and the MMA is looking forward to seeing, in the near future, concrete recommendations and guidelines for the future of the health services of the country.

CHANGE OF NAME OF OUR JOURNAL

THE MEDICAL JOURNAL OF MALAYA has been a quarterly publication (Sept., Dec., Mar., June) issued by the Malaya branch of the British Medical Association ever since September 1946. The Editor is elected at the Annual General Meeting each year and serves on the Council of the Association. When the Malayan Medical Association succeeded the Malaya branch of the British Medical Association, the Medical Journal of Malaya continued as the official publication of the MMA.

It was originally published by Young Advertising and Marketing Ltd. and on their recommendation in 1966, during the editorship of Professor A.A. Sandosham, the publication was undertaken by the Straits Times Press and printed by Times Printers Ltd. on behalf of the Malayan Medical Association. Last year, the name of the Association became registered as the Malaysian Medical Association in keeping with the national character of the organisation. Accordingly, it has been decided to change the name of the Journal, with the commencement of the next new volume of the journal. Notice is hereby given that the name of our quarterly publication will be changed from "The Medical Journal of Malaya" to "The Medical Journal of Malaysia" commencing with the September, 1972 issue but the volume will continue the serial number, i.e., it will be Vol. XXVII No. 1. Sept. 1972.

Positive contrast (Pantopaque) myelography: with a note of its current status

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IT IS MORE than 50 years since Dandy (1919) first attempted the visualisation of spinal cord tumours by introduction of air into the subarachnoid space. The development of positive contrast myelography, however, came about by accident, when Sicard and Forestier (1922) accidentally introduced Lipiodol into the subarachnoid space and observed free movement of the contrast material. Before long, investigators were using Lipiodol in the investigation of spinal cord lesions. By about 1934, positive contrast myelography achieved widespread popularity and replaced air myelography as the method of choice.

Lipiodol has its inherent drawbacks in that globules formation makes interpretation difficult and its irritant effect on the pia arachnoid could eventually lead to adhesive arachnoiditis. The introduction of the relatively non-irritating Pantopaque in 1944 was a major step in the development of this procedure. The current accepted practice is to use quantities ranging from 10 to 20 c.c., depending on the site of examination. As a rule, use of such large amount necessitates removal of as much of the contrast material as possible after the examination, although in some instances, it may be desirable to leave it behind should a re-examination is contemplated.

Pantopaque Arachnoiditis

Also marketed as Myodil in some countries, Pantopaque is a mixture of ethyl esters of isomeric iodophenyundecylic acid, and contains 30% of organically bound iodine. It has a specific gravity of 1.260 and is much less viscous than Lipiodol, enabling it to flow more freely and does not globulate as easily. It is a relatively inert substance and when left behind in the subarachnoid space is slowly absorbed at the approximate rate of 1 c.c. per year. Very rarely a low-grade arachnoiditis is reported (Grainger 1960). However, arachnoiditis following repeated diagnostic lumbar punctures alone is a common enough observation for one to reflect that Pantopaque by itself should not be readily incriminated as the causative factor. In the two fatalities reported in the literature (Erickson and Van Baaren 1953; Mason and Raaf 1962) cause of death was thought to be due to extensive basal adhesive arachnoiditis. Mason and Raaf postulated

that the initiating factor was a hypersensitivity reaction to Pantopaque leading to an aseptic meningitis. Both Epstein (1969) and Gass (1963) stated that fear of severe or fatal sequelae, following spill of Pantopaque into the cranial cavity, had been unjustifiably overstressed.

Animal experiments have shown that blood has a potentiating action in the production of moderately severe or very severe arachnoiditis in company with Pantopaque (Howland and Curry 1966). These severe reactions were observed more consistently than those produced by Pantopaque alone. Therefore, it may not be advisable to carry on with a Pantopaque myelogram if bleeding had occurred following a spinal puncture. Equally important is the care exercised to avoid subarachnoid bleeding during removal of the contrast material. Some workers advocate the administration of steroids in such cases to forestall the onset of arachnoiditis but results have not been persistingly encouraging. The whole question of pathogenesis of Pantopaque arachnoiditis still awaits clarification. As a whole, it is a satisfactory agent matching the ideal myelographic medium in many ways.

Technique of Examination

The examination can be performed via a lumbar or cisternal puncture. It is not intended to deal in any detail on the former except to stress the importance of a non-traumatic puncture before introducing the contrast. The patient should not be subjected to a diagnostic lumbar tap for at least a week prior to the examination to avoid creating a communication between the subarachnoid and the subdural space. A subdural injection of contrast renders the whole examination uninformative and makes interpretation of future examinations difficult. It is wellknown that sciatic pain can be produced by abnormalities as high as D9 and D10 levels. In investigating suspected lumbar disc herniation, it is mandatory to run the contrast up to at least the mid-dorsal region. The patient should also be examined supine, particularly in suspected arachnoid diverticula and vascular anomalies which are located usually in the dorsal aspect of the cord.

Cisternal Puncture

Because of the adequate information obtained by the lumbar route using large amount (18 to 24 c.c.) of Pantopaque in the investigation of high cervical and thoracic lesions, the cisternal route is infrequently employed unless for the following reasons:

(i) To demarcate the superior margin of an obstructive lesion particularly when obstruction is complete.

(ii) When lumbar puncture is contra-indicated, as in cases of infection or in conditions where a low termination of the spinal cord is suspected.

The patient is preferably examined prone on a tilting X-ray couch. The head is slightly flexed and the couch inclined at approximately 20° with the patient's feet down. This allows the contrast to gravitate towards the cervical spine. The use of fluoroscopy with image intensification and television monitoring aid the procedure considerably as the examiner can determine the position of the needle in relation to the spine. The direction of flow of contrast when introduced into the subarachnoid space can also be observed.

The area of skin in the suboccipital region is shaved and a small amount of xylocaine 1% is infiltrated into the subcutaneous and deep tissues. A small short bevel spinal needle of approximately 7-8 cm. in length is inserted in the mid-line in the depression between the spinous process of C2 and the base of the skull (De Jong 1967). The point of insertion is determined by drawing a horizontal line that joins the tips of the mastoids and intersecting the mid-line at right angles. The direction of the needle is parallel to the cantho-meatal line initially (Fig. 1).

DIAGRAM ILLUSTRATING THE TECHNIQUE OF CISTERNAL PUNCTURE (AFTER R. SHAPIRO).

Fig. 1: Cisternal puncture. Dotted needle shows initial position in relation to skull base. (CM=cisterna magna).

When the needle strikes the skull base it is withdrawn slightly and re-directed a little more vertically. It is now slowly advanced anteriorly and superiorly to skirt the rim of the foramen magnum and pierce the atlanto-occipital ligament. A characteristic "give" is felt by the examiner as the ligament is traversed. The stylet is now removed for cerebral spinal fluid (CSF) to flow out to indicate entry into the cisterna magna. The needle is advanced a further 2 to 3 mm. to ensure its tip is in the centre of the cistern. Failure to do so may result in partial extravasation of contrast into the subdural space during injection. About 3 to 4 c.c.

of CSF are now removed and the same amount of Pantopaque slowly injected. The needle is now withdrawn and the patient asked to extend his neck to facilitate gravitation of contrast into the cervical lordotic curve. Fluoroscopy and spot filming may now be carried out in the usual way.

Complications

These are listed in Table 1. Rare but serious complications of cisternal puncture include subarachnoid haemorrhage and accidental puncture of the brain stem.

nation showed Protein: 240 mgm%, RBC: 124/m.m.^{3} and Sugar: 14 mgm%. Plain X-ray of lumbo-sacral spine disclosed slight narrowing of L4/L5 disc space. Myelogram revealed a partial block at L3/L4 and a disc lesion at L4/L5 level. There was a serpentine shadow in the upper lumbar region extending cranially to the mid and lower dorsal spine. Findings were in keeping with a vascular anomaly (Fig. 2).

Comments

The above case illustrates a typical myelogra-

TABLE 1

LIST OF 4 SIGNIFICANT COMPLICATIONS OF PANTOPAQUE MYELOGRAPHY

Complications	Authors	Clinical Manifestations	Remarks
(1) Venous Intravasation (following sudden rise in C.S.F. pressure)	Hinkel (1945)	Pulmonary embolism.	Recovery
(2) Adhesive Arachnoiditis	Davis (1956)	118 cases of myelography reviewed. Symptoms include: chronic headaches, back pain, incontinence, intercostal neuralgia, paraesthesia of 4 extremities.	8 confirmed cases of arachnoiditis (5 at laminectomy, 3 at post-mortem, patients dying from unrelated causes).
(3) Severe meningeal irritation	Taren (1960)	Patient developed cranial nerve palsies and stupor.	Recovery
(4) Aseptic Meningitis and Death	Erickson and Van Baaren (1953)	Patient had hypersensitivity reaction the next day. Progressive illness of 15 months.	Death. Basal adhesions hydrocephalus.
	Mason and Raaf (1962)	Hypersensitivity reaction immediately after procedure. 7 months of progressive illness.	Death. Extensive exudative basal adhesions.

Indications

Indications are numerous and varied. It is difficult to outline a comprehensive set. The following are some conditions selected with a view to bring its value and limitations into better perspective.

I. Congenital: Vascular Malformations

Case 1

A 39-year-old male Indian patient complained of low back pain, and urinary and faecal incontinence for one month. Physical examination disclosed a positive Kernig's sign with saddle anaesthesia over S2 to S4 dermatomes. Knee and ankle jerks were diminished. Cerebral spinal fluid examiphic picture of the condition. The myelographic features in some respects are dependent on the morphology of the lesions. Pathologically, they are divided into four categories (Teng and Papatheodorou 1964), the commonest being the venous anomalies followed by the arterial, arterio-venous and the telangiectatic varieties. Myelography is an indirect means of visualisation of these lesions and, where possible, should be supplemented by selective aortic or vertebral arteriography, if ligation of the arterial feeders is contemplated (Houdart, Djindjian and Hurth 1966). Contrary to popular belief, these anomalies are not rare but are often overlooked because of inadequate examination and

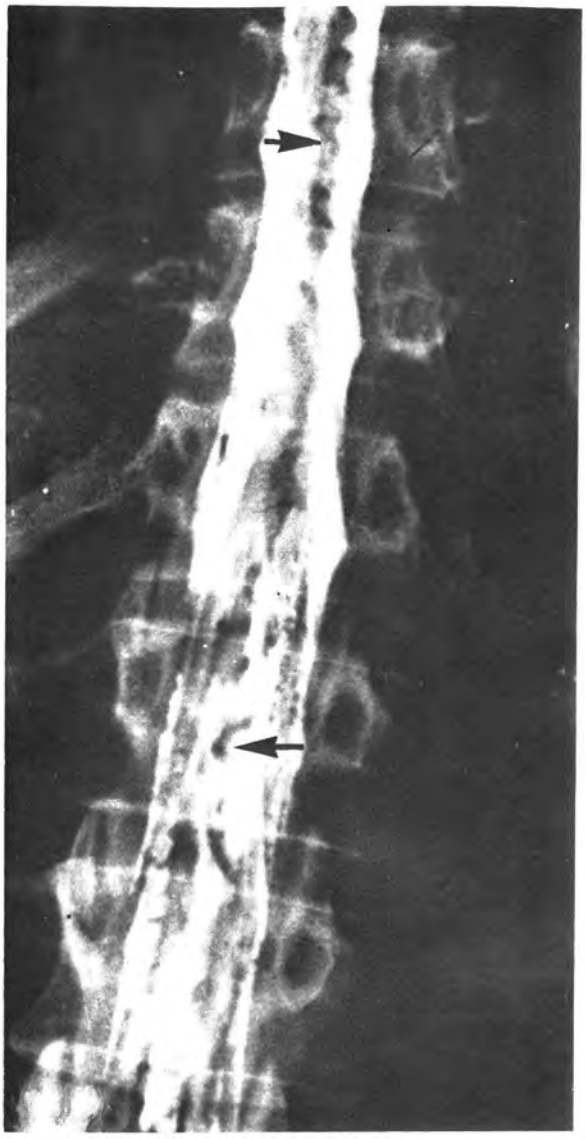

Fig. 2: Angioma of the spinal cord. Serpentine shadow extending from lumbar to lower dorsal region (arrows).

atypical presentation at myelography. In Teng and Papatheodorou's series, only two of their 15 cases had a correct preoperative diagnosis. In the remaining cases, the myelographic features were bizarre and provided no indication of a vascular lesion. A few cases with irregular filling defects were mistakenly labelled as arachnoiditis preoperatively.

II. Post Traumatic Sequelae: Brachial Plexus Injury

Case 2

A 23-year-old male Indian patient sustained an injury to his left shoulder and upper arm following a motor vehicle accident two years ago. He was unable to move his left upper limb ever since and

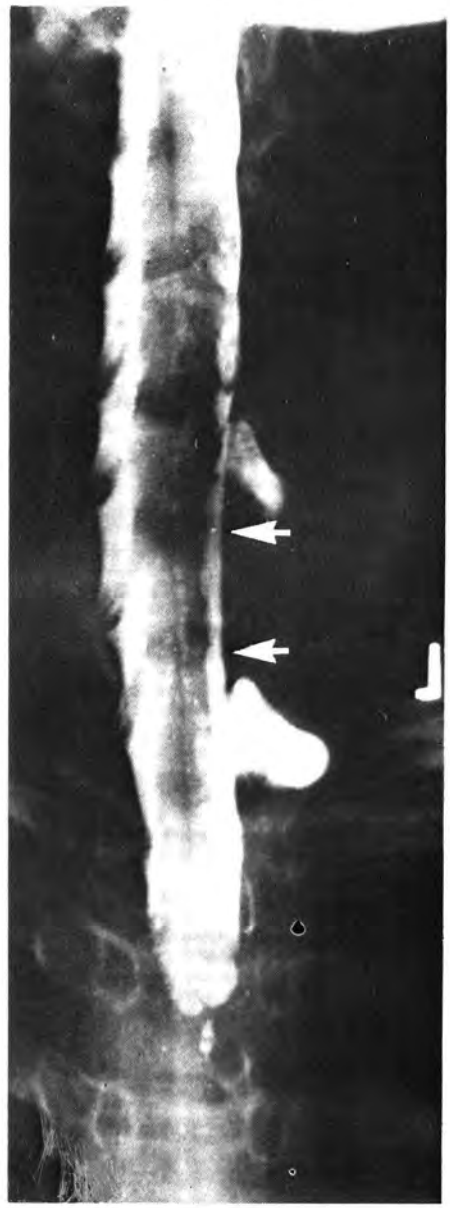

Fig. 3: Characteristic appearance of post-traumatic brachial plexus injury. Contrast filling of dural sacs with smooth indentation on contrast column (arrows).

there was also loss of sensation. Examination showed wasting of the deltoid and supraspinatus muscles. Motor power of the left upper limb was absent. There was loss of sensation below the left elbow joint. Reflexes were also absent. Plain X-rays disclosed an old fracture of the left clavicle. Myelogram showed contrast filling of the dural sacs at D1/D2 and C6/C7 levels (Fig. 3). Here, the cord shadow was slightly indented on the left. Filling of the normal root pouches was absent. The findings pointed to a traumatic spinal meningocoele situated extradurally, displacing the cord slightly.

Comments

The characteristic contrast filling of the dural sacs was observed by Murphy, Hantung and Kirklin as early as 1947. Since then, Davis and Sutton (1966) reported 11 cases and reviewed 70 more in the literature. The common important myelographic features are as follows:—

(i) A dural or extradural sac forms opposite the intervertebral foramen of the torn root extending sometimes through it. Contrast usually fills the sac and demonstrates unequivocally its extent.

(ii) Obliteration of the root pouch by healing of the tear. The lateral margin of the myodil column in such instances will be straight or convex medially due to a loculated cystic collection of CSF.

(iii) The width of the partially torn root will be less than the normal as it crosses the subarachnoid space. In the myelogram, it shows up as absence of the root shadows in the contrast column.

The features described under (i) and (ii) are found in the present case. The prognosis in common with so many of these conditions is poor. If more than two nerve roots are torn, the injuries are invariably irreversible. Myelography has the advantage of examining the nerve roots involved without recourse to operation. It gives a precise picture as to the site and extent of the injury although at times it may underestimate its severity. Once diagnosis is established, laminectomy is rarely indicated except to exclude an intraspinal cause for intractable pain which may sometimes be the primary presenting symptom. The contrast filled dural sacs have to be differentiated from non-traumatic diverticula of the subarachnoid space (Fig. 4) which have smooth, rounded contours and exhibit normal radiolucent outlines of intact nerve roots.

Fig. 4: Small subarachnoid diverticula (arrows), an incidental finding at myelography.

III. In the Investigation of Atrophic Cord Lesions: Syringomyelia

Case 3

A 28-year-old Malay man gave a history of numbness of the right little finger for two years and progressive weakness and sensory loss of both upper limbs for six months. He was found to have

dissociated anaesthesia of temperature and pain at dermatomes C3 to D4 on examination. Other positive findings include wasting of the shoulder girdle muscles, the thenar, supraspinatus and deltoid muscles bilaterally. Involuntary tremors of fingers and fasciculation of the right shoulder girdle muscles were present. The clinical impression was syringomyelia. Plain films of the cervical spine showed an increase in the sagittal diameter of the lower cervical canal. A myelogram demonstrated unequivocally smooth and diffuse enlargement of the cord shadow from C2-D2 (Fig. 5). The subarachnoid space was narrowed. The findings were consistent with syringomyelia, although an extensive intramedullary tumour was considered in the differential diagnosis. Laminectomy confirmed the radiological diagnosis of syringomyelia.

Comments

The plain X-ray findings of the cervical spine in these patients consist of an increase in the transverse or sagittal diameter of the canal or a combination of both. This is the rule in the males whereas female patients may show normal looking canals despite characteristic clinical manifestations (Bradley and Banna 1968).

Fig. 5: Characteristic appearance of syringomyelia. Smooth symmetrical enlargement of cervical cord shadow.

There may be cervical lordosis and thoracic kyphoscoliosis due to muscle imbalance. Rarely, abnormalities of the craniovertebral junction are encountered. Myelography usually demonstrates smooth symmetrical enlargement of the involved segments. The main differential diagnosis is from an intramedullary tumour, usually a glioma. The problem is made more complex by the occasional association of these two conditions in the same patient. Indeed, McRae (1966) considered intramedullary glioma with cystic formation as a cause of what he termed "secondary syringomyelia". Other common associated features include a small collapsing spinal cord when the patient assumes the erect position, subarachnoid adhesions and Arnold-Chiari malformation.

IV. Tumour Localisation and Diagnosis

Case 4

A 12-year-old female Indian patient gave a history of progressive weakness of both lower extremities for one year. At the time of admission to the University Hospital, she was unable to walk. Examination revealed the motor power of both lower limbs to be weak. Knee and ankle jerks were brisk and plantar response was extensor bilaterally. Tenderness over the lower dorsal region was elicited on palpation. The clinical impression was cord tumour with spinal compression.

Radiological examination: Plain films of the dorsal spine showed pedicle erosion and scalloping of the posterior border of body of D10. The intervertebral foramen was also enlarged and pressure erosion of the vertebral end of the right ninth rib was noted. A myelogram via the lumbar route showed a complete block at D9/D10 disc space and smooth deviation of the contrast column and the cord shadow towards the left (Fig. 6). An extradural mass at the lower dorsal spine was thought to be responsible for her disability.

A descending myelogram showed a complete block at the lower border of D8, again with deviation of the contrast column and the cord shadow to the left. The lateral films pointed to a posterior situation of the mass. The radiological diagnosis was an extradural tumour, most likely a neurofibroma. Laminectomy showed a large extradural neurofibroma 2" x 2½" in size situated on the right of D9 spinal segment, compressing and displacing

Fig. 6A: Extradural neurofibroma. Lumbar myelogram shows smooth tapering of head of contrast column and deviation cord shadow to the left: characteristic appearance of extradural lesion. Note pedicle erosion of D9 and D10.

the cord to the left. Part of the tumour was extraspinal extending through the intervertebral foramen along the right 9th intercostal nerve. The tumour was removed and histopathology confirmed the diagnosis at operation.

Comments

This case illustrates the distinct value of myelography as a means of localisation. That the tumour had an extraspinal component was shown by the presence of rib erosion. Because of the size of the tumour, a complete obstruction was present. A cisternal myelogram was conclusive in demarcating its superior margin. A completely extradurally situated neurofibroma is relatively rare. According

Fig. 6B: Descending myelogram of same patient. Shows similar tapering appearance, indicating tumour at D9 level.

to Shapiro (1968), only 16% of neurofibromas are thus situated as compared to 67% of the intradural varieties. Another 16% occupy an intradural position with an extradural component. The great majority of neurofibromas are situated in the thoracic (43%) and lumbar (33%) regions. Bone changes, as shown in this case, are about four times as frequent when compared with meningiomas. This observation was also made by Elsberg and Dyke (1934) who stated that "enlargement of the interpedicular distance and erosion of the inner border of the pedicles occurred much more often in neurofibromas than in the meningiomas."

Although the small intradural neurofibromas do not characteristically erode adjacent bones, the larger intradural and extradural varieties commonly cause bone changes ranging from vertebral scalloping to thinning of the neural arches. Two or more vertebral bodies may become involved at the same time. On purely radiological grounds, differentiation from an extradural meningioma, lymphoma, granuloma and metastatic tumour could be problematical. Taking into consideration the age, the location and characteristic bone changes, a correct preoperative pathological diagnosis is often possible.

V. Investigation of Cervical Spondylosis

This is done in patients with severe radicular symptoms and cervical myelopathy (Jackson 1966) and as a preliminary assessment before operation (Logue 1957).

Case 5

A 64-year-old female Chinese complained of numbness over the right index and middle fingers, and severe pin-prick pain over the lower right scapula radiating down the right arm and fingers for 3-4 weeks prior to admission to the University Hospital. The pain was more marked on exertion. Examination disclosed slight wasting of the thenar muscles. There was sensory deficit over the palmar and dorsal aspects of the right index and middle fingers.

Radiological examination: There were degenerative changes in the cervical spine. The sagittal diameter of the canal was within normal limits. A cervical myelogram showed poor filling of the subarachnoid root sheaths on the right. Multiple transverse radiolucent shadows were seen corresponding to the disc spaces at C_3/C_4, C_4/C_5, C_5/C_6 and C_6/C_7 levels (Fig. 7). The impression was moderate to marked cervical spondylosis.

Case 6

A 48-year-old male Indian patient presented with a four-month history of progressive weakness of the left arm. There was associated paraesthesia affecting the left shoulder and the fingers. Examination showed gross wasting and loss of tone of the left upper limb. There was sensory deficit over the distribution of C_5 to D_1 dermatones on the left. The clinical impression was motor neurone disease. A myelogram was done to rule out an intraspinal

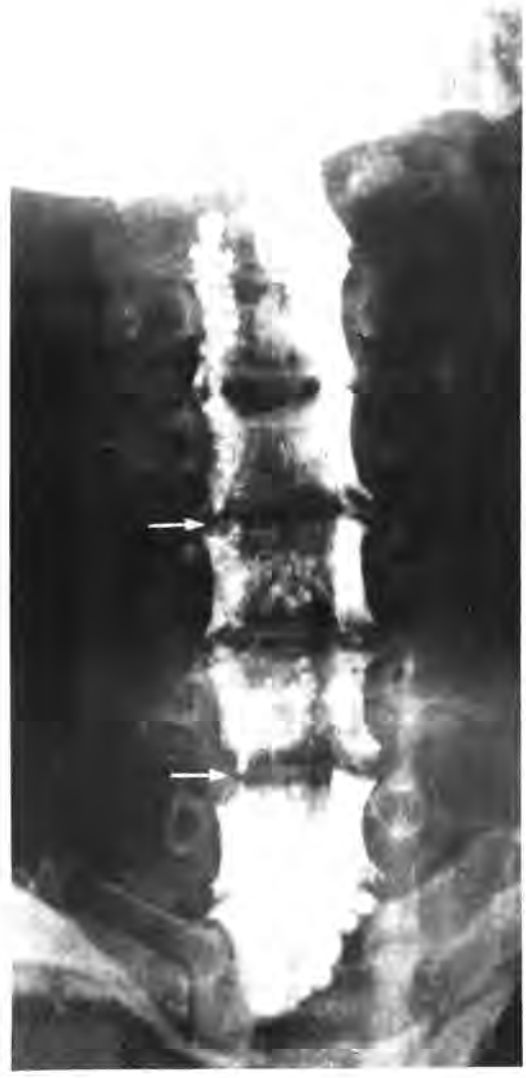

Fig. 7: Cervical spondylosis. Multiple transverse radiolucent shadows at C_3/C_4, C_4/C_5, C_5/C_6 and C_6/C_7 interspaces. Root sheaths on the right are poorly filled (arrows).

tumour. There was no evidence of blockage to the flow of contrast material cranially and the cord shadow appeared normal throughout. However, transverse filling defects were noted in the contrast column at C_4/C_5 and C_5/C_6 levels, the appearance being suggestive of annular protrusions at these levels. Lateral views (Fig. 8) confirmed these findings. In addition, there were minimal indentations on the posterior aspect of the opacified subarachnoid space indicative of thickening of the flaval ligaments. The final impression was mild cervical spondylosis which was not considered responsible for his marked neurological deficit.

Fig. 8A: Cervical spondylosis. Transverse radiolucent shadows at C_5/C_6 and C_6/C_7 interspaces. Arrows indicate non-filling of axillary root sheaths.

Case 7

A 51-year-old male Indian patient developed progressive weakness and numbness of both upper and lower extremities three months prior to admission to the University Hospital. A history of antecedent injury was not obtainable. Examination showed motor power of all four limbs to be slightly decreased. Sensation was diminished below C4 level. Co-ordination was poor and all reflexes were brisk. The plantar response was extensor bilaterally.

Fig. 8B: Lateral view of same patient in Fig. 8A showing ventral indentations by posterior osteophytes and dorsal indentations by flaval ligament (arrows).

Radiological examination: Plain films of cervical spine showed a decrease in height of the C_3/C_4 intervertebral space with a light posterior displacement of C_3 and C_4. The sagittal diameter of the canal was narrow at this point. Myelogram showed a marked transverse filling defect at C_3/C_4 intervertebral space. The opacified ventral subarachnoid space was indented at this level (Fig. 9). The changes pointed to either a focal cervical spondylosis or a posterior disc protrusion.

Viewed together with the clinical findings, the provisional diagnosis was cord compression at C_3/C_4 level.

Fig. 9: Focal cervical spondylosis. Cervical myelogram (lateral view) shows ventral indentation of opacified subarachnoid space at C_3/C_4 level (arrows).

A decompression laminectomy of C_3, C_4 and C_5 segments showed sclerosis and calcification of the ligamenta flava and the posterior spinal ligament. A bony or cartilaginous bar was felt at the posterior surface of the C_3/C_4 disc space. The spinal cord was pale and not pulsating.

Post-operatively, the patient made a satisfactory recovery and had no neurological deficit except some residual weakness of the right shoulder on discharge six weeks later.

Comments

In essence, clinical cervical spondylosis, be it diffuse or focal, is caused by the encroachment of abnormal degenerative tissues upon normal nervous tissues. Although plain X-rays are able to some degree to estimate the severity and extent of the degenerative process, the changes in the soft tissues that constitute part of the cervical canal can only be accurately assessed by positive contrast myelography. This particularly applies in cases where the plain film changes do not correlate with the clinical manifestations (Brain 1954) (Penning 1968). As a rule, Pantopaque myelography gives reasonably accurate information as to nerve root impingement by root sleeve fibrosis or by uncovertebral and posterior apophyseal osteoarthritis. Posterior annular herniation and fibrocartilaginous bar protrusions may similarly be demonstrated. The lack of adequate filling of the root sheaths on the right in Case 5 are characteristic of uncovertebral osteoarthritis which is the most likely explanation of the patient's symptoms. These findings are substantiated by the plain radiographs which showed moderate degrees of osteophytic encroachment on the exit foramina on the same side. The multiple radiolucent defects present in the disc spaces from C_3 down to C_7 represent cartilaginous bar impressions but in the presence of a roomy cervical canal symptoms of cord compression may not necessarily arise (Burrows 1963).

Case 6 is an example of how a myelogram can help in excluding a suspected case of intraspinal tumour. No tumour could be found and the appearance of mild cervical spondylosis was just incidental and may be considered a physiological degenerative process (Smith 1968).

Case 7 is an example of focal spondylosis affecting essentially the C_3/C_4 intervertebral space. Here, myelography underestimates the pathologic anatomical changes found at operation. Radiologically, the findings show a reasonably healthy cervical spine apart from the slight malalignment and disc space narrowing. At laminectomy, the cord exhibits changes of marked ischaemia resulting from circumferential thickening and sclerosis of the flaval and posterior spinal ligaments. That neighbouring soft tissue changes are mainly responsible for his symptoms is proven by a rapid recovery following a decompression laminectomy. Stoltmann and Blackwood (1964) have shown experimentally a very "tight fit" of the cervical canal at C_4, C_5 and C_6 levels and there is just adequate room for the cord to move freely under normal circumstances. Pathological changes, such as thickening of the flaval ligaments in particular, can further narrow the canal and produce compression on the posterolateral columns, with resultant demyelination. Although this view is not universally accepted, there is enough evidence to justify surgical decompression if the patient is sufficiently incapacitated clinically.

In summary, myelography in cervical spondylosis serves the following purposes:

(i) It affords a functional study of the CSF dynamics with the patient's neck in flexion, extension and neutral position. This technique is enhanced by the use of cinemyelography.

(ii) Soft tissue changes are demonstrable indirectly. These findings may then be correlated with abnormal features on the plain films.

(iii) Demonstration or exclusion of co-existing lesions giving rise to a similar clinical picture is an absolute indication. The line of management adopted is dependent on the result of such studies. Thus, a high cervical cord tumour or an acute nuclear prolapse will require surgery, whereas mere presence of mild to moderate diffuse spondylosis may only require conservative treatment.

VI. In the Investigation and Management of Adhesive Arachnoiditis

This condition was extensively reviewed by Epstein (1969) and Lombardi and Pessarini (1962). The clinical picture is often confusing and when acute, may simulate a spinal tumour. Myelography is used to exclude an intraspinal lesion and to define the extent of the arachnoiditis. This is necessary if a more aggressive approach to this problem is adopted. Teng and Papatheodorou (1967) listed six forms of myelographic appearances in an analysis of 12 cases and noted satisfactory response to surgery in half of them.

In general, there are no clear-cut myelographic features as the changes are dependent on the underlying causative pathology. The common causes are inflammatory disease, post-traumatic and

spontaneous bleeding into the subarachnoid space. Other factors include repeated diagnostic lumbar punctures, spinal anaesthesia and the effects of spinal surgery. In almost half the cases, a definite causative factor cannot be traced. The myelographic appearances are polymorphous and bizarre.

Fig. 10: Myelographic features of arachnoiditis. Myelogram in June 1968 shows partial block beginning at D10 level and extending cranially to D8. Irregular, streaky appearance of contrast column and tortuous vessels (arrows). Cord shadow not shifted.

The contrast column breaks up into multiple irregular loculated pockets and movement of the contrast column is extremely slow to the point of complete obstruction in areas where the subarachnoid space is completely obliterated. Because of the extensive adhesions, the surrounding venous plexuses become congested and serpentine like shadows, representing either dilated vessels or thickened proliferative arachnoid tissues, may be seen. Where areas of the cord cavitate as a result of ischaemia local segments of cord enlargement may easily simulate an intramedullary tumour or syringomyelia.

Figure 10 is the myelogram of a female Chinese patient in her early thirties, with symptoms and signs suggestive of a cord tumour two years ago. A myelogram done in June 1968 showed an almost complete block of the contrast column at D8/D9 level. The upper border of the contrast column was irregular and streaky and there was no sign of cord displacement. The diagnosis then was arachnoiditis. Her symptoms showed no change over a period of two years. Just prior to admission in August 1970, she noticed some aggravation of symptoms. On re-screening the D8 region, a similar myelographic appearance was observed. A descending myelogram showed slight enlargement of the cervical cord shadow from C3 to C7 in the AP projections. On manoeuvering the contrast into the lower dorsal region, a partial block from D8 to D10 level was redemonstrated (Fig. 11). On the basis of the protracted course of the illness and the bizarre myelographic features, the final diagnosis was arachnoiditis affecting the lower dorsal and the cervical spinal cord with possible cavitations in the dorsal segment.

Discussion

In the light of recent development of soluble contrast material and refinement in technique, the status of the conventional myelographic procedure may warrant reappraisal. The case reports have clearly illustrated its diagnostic accuracy and simplicity of operation without causing undue discomfort to the patient. Throughout the spine, there is a great range of abnormalities in which demonstration and interpretation of the lesions could be readily accomplished by the general radiologist.

The use of soluble contrast media as Cunray 282 has the advantage of improving the quality of myelograms (Praestholm and Lester 1970). Side-effects, such as headache and clonic muscle spasms, can be disturbing to the patient. Escape of this contrast into the lower dorsal region can precipitate severe myoclonia of the lower extremities. Its use is confined therefore exclusively to examina-

tion of the lumbar spine under experienced hands.

Air myelography has its advocates in America and the Scandinavian countries. The disadvantage lies in the almost complete replacement of CSF by air leading to post-myelographic headaches. Other factors, such as overlying bowel shadows and the density of the vertebral bodies, make interpretation difficult. Tomography may, to an extent, resolve these difficulties but because of the poor definition of the cord in frontal projections non-obstructive lesions such as vascular malformation, subarachnoid diverticula and arachnoiditis can be easily overlooked. Minor defects may escape attention because this procedure does not afford the use of fluoroscopy. It has distinct value in the detection of lesions at the cervical and foramen magnum regions and the study of atrophic lesions of the cervical and thoracic segments of the cord.

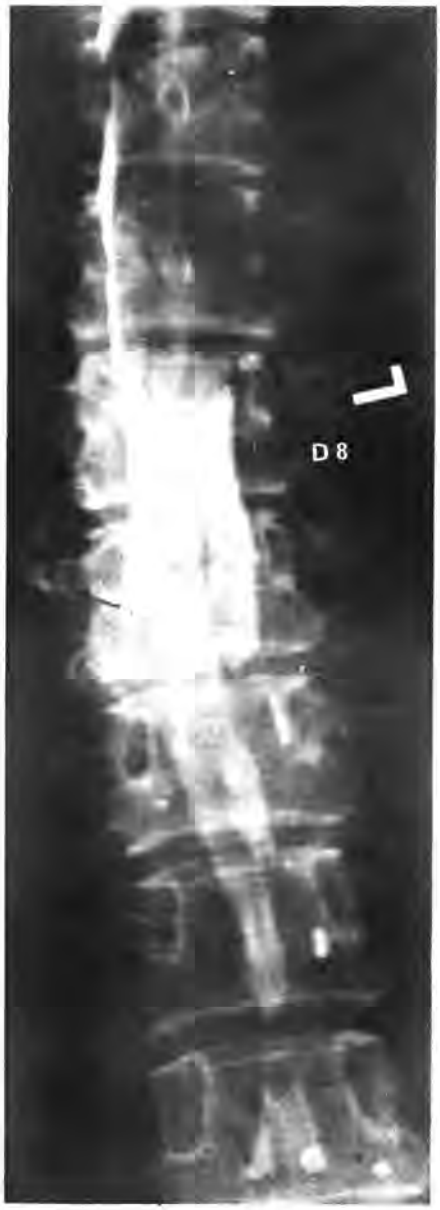

Fig. 11: Myelogram in August 1970 of same patient as Fig. 10. Redemonstration of partial obstruction at D8 level. Non-filling of subarachnoid space on the left at D6 and D7 levels with very narrow subarachnoid space on the right. Possible explanation is local cavitation of the cord or obstruction due to thickened arachnoidal tissue.

Pantopaque myelography has now reached a stage when additional enhancement technique can transform it into a more effective diagnostic tool. Cinemyelography (Epstein 1967), the instillation of large amount of contrast under image intensification-television control and the use of less dense Pantopaque have brought about less technical error and a more thorough and exhaustive search for lesions.

Cinemyelography

This technique has added ease and accuracy to the procedure. It provides a total recall of the movement and behavior of the contrast material especially in the cervical spine. It enables a physiological and dynamic study of the subarachnoid space to be carried out.

Use of less dense Pantopaque

This technique was studied by Heinz, Brinker and Taveras (1966). In their comparative studies, using large volumes of Pantopaque of different Iodine concentrations (30%, 22% and 15%), they concluded that in the detection of lesions in the cervical spine, Pantopaque 22% had a distinct advantage over Pantopaque 30%. Whereas the use of Pantopaque 30% necessitates a higher kilovoltage technique to increase the visibility of the cervical cord shadow, this is achieved at the expense of loss of neighbouring bone detail. Using a conventional technique, the same good visibility could be obtained with 22% Pantopaque without sacrificing bony detail. In the lumbar spine, small extra-dural impressions could be detected more readily with the use of Pantopaque 15%.

Urea in Positive Contrast Myelography

Calabro and Smaltino (1966) examined nine cases by this method. The rationale of this procedure is the shrinkage of the spinal cord following intravenous administration of a hypertonic urea solution in doses of 0.8 gm. per kilogram of body

weight. Where a complete block was noted, the administration of this substance changed it into an incomplete one, making it possible to visualise the extent of the lesion responsible for the obstruction. In their small series, the exact level of each of three cases of intraspinal tumours was thus located. No serious side-effects were reported apart from a transient headache. This method is invaluable if for any reason a combined cisternal myelogram is contraindicated.

Thus the enhancement techniques supplement and do not supplant the conventional procedure, which will continue to occupy an important place in the armamentarium of the diagnostic radiologist.

Summary

(1) The question of Pantopaque arachnoiditis is briefly discussed.

(2) A technique of cisternal myelography is described.

(3) Various complications pertaining to myelography are listed.

(4) Examples are presented to illustrate the main indications of Pantopaque myelography.

(5) Some recent enhancement techniques are briefly reviewed.

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References

1. Bradley, W.G. and Banna, M. (1968): **Brit. J. Radiol., 41,** 608.
2. Brain, R. (1954): **Lancet, I,** 687.
3. Burrows, E. (1963): **Clin. Radiol., 14,** 77.
4. Calabro, A. and Smaltino, F. (1966): **Acta Radiologica, Seventh Symposium Neuroradiologicum, 5,** 985.
5. Davis, E.R. and Sutton, D. (1966): **Brit. J. Radiol., 39, 362.**
6. Davis, F.L. (1956): **Lancet, 271,** 747.
7. De Jong, R.N. (1967): Neurologic Examination, 3rd Ed., p. 1074, New York, Hoeber Medical Division.
8. Epstein, B.S. (1967): Progress in Radiology, p. 42, Ed. Turano, L., Amsterdam, Excerpt Medical Foundation.
9. ..... (1969): The Spine: A radiological text and atlas, 3rd Ed., p. 136, Philadelphia, Lea and Febiger.
10. Erickson and Van Baaren (1953): **J.A.M.A., 153,** 636.
11. Gass, H. (1963): **Amer. J. Roentgenol., 90,** 1197.
12. Grainger, R. (1960): Modern Trends in Diagnostic Radiology, Third Series, p. 269, Ed. McLaren, J.W., London, Butterworth.
13. Heinz, R.E., Brinker, R.A. & Taveras, J.M. (1966): **Acta Radiologica, 7th Symposium Neuroradiologicum, 5,** 1024.
14. Hinkel, C.L. (1945): **Amer. J. Roentgenol., 4,** 230.
15. Houdart, R., Djindjian, R. & Hurth, M. (1966): **J. Neurosurg., 24,** 583.
16. Howland, W.J. and Curry, J.L. (1966): **Acta Radiologica, 7th Symposium Neuroradiologicum, 5,** 1032.
17. Jackson, R. (1966): Cervical Syndrome, 3rd Ed., p. 209, Springfield, Thomas.
18. Logue, V. (1959) in Modern Trends in Disease of the Vertebral Column, Chapter 9, Ed. Nassim, G. and Burrows, H.J., London, Butterworth.
19. Lombardi, G., Passerini, A. and Migliavacca, F. (1962): **Brit. J. Radiol., 35,** 314.
20. Mason, M.S., Raaf, J. (1962): **J. Neurosurg., 19,** 302.
21. McRae, D.L. and Standen, J. (1966): **Amer. J. Roentgenol., 98,** 695.
22. Murphy, F., Hantung, W. and Kirklin, J.W. (1947): **Amer. J. Roentgenol., 58,** 102.
23. Penning, L. (1968): Functional Pathology of the Cervical Spine, p. 96, Amsterdam, Excerpta Medica Foundation.
24. Praestholm, J. & Lester, J. (1970): **Brit. J. Radiol., 43,** 303.
25. Sicard, J.A. and Forestier, J. (1922) cited by Shapiro.
26. Shapiro, R. (1968): Myelography, 2nd Ed., p. 267, Chicago, Year Book Medical Publishers.
27. Smith, B.H. (1968): Cervical Spondylosis and its neurological complications, p. 126, Springfield, Thomas.
28. Stoltmann, H.F. and Blackwood, W. (1964): **Brain, 87,** 45.
29. Taren, J.A. (1960): **J. Neurosurg., 17,** 323.
30. Teng, P. and Papatheodorou, C. (1964): **Brit. J. Radiol., 37,** 358.
31. ..... (1967): **Brit. J. Radiol., 40,** 201.

Cytological characteristics of gynaecological specimens referred to Cytology Division, I.M.R. in 1970

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CENTRAL LABORATORIES which routinely process a large number of samples can often make an additional health science contribution by summarising and communicating the results of studies based on materials from many different sources. This may be particularly true in the case of a new procedure or newly-established laboratory such as the IMR Department of Cytology and Cytogenetics, established in June 1968. The purpose of this paper is to summarise the cytological variations observed in the different age and racial groups with reference to contraceptive usage in Malaysia and to discuss briefly some sociological and biological considerations raised by these variations.

Source of specimens

The 1970 specimens were chosen as the basis for this first report because of more complete information available on each of more specimens than for earlier years.

Although the majority of these specimens came from the state of Selangor which includes the Federal capital, Kuala Lumpur, the major urban area of the country, other less urban areas are also represented, particularly by the family planning clinics (Table I). From Table 1 it can be computed that approximately 69% of these specimens were from family planning clinics, with 24% of the specimens coming from government hospitals and the remaining 7% from private clinics. From Table 2 it can be computed that 74% of the specimens from the family planning group were oral contraceptive (pill) users, with 35% and 24% being the respective analogous values for the government hospital and private clinic groups. Due to the rather small numbers, we have omitted from subsequent consideration in this report the 558 specimens from those women using some form of contraceptive other than the pill (Table 2).

The racial origins and contraceptive usage of those Malaysians from whom the specimens were obtained are given in Table 3, with 61 specimens being excluded from subsequent consideration in this report because of unsatisfactory smears, and 776 specimens being excluded because the patient's age and/or race was unspecified or other than

Table 1

Number of specimens by type and location of medical facility

State	Type of Medical Facility			
	Family Planning Clinic	Government Hospital	Private Clinic	Total
Selangor	6201	1621	843	8665
Pahang	664	1060	3	1727
Malacca	650	105	2	757
Johore	355	140	4	499
N. Sembilan	297	33	12	342
Kelantan	6	130	0	136
Trengganu	0	31	0	31
Perak	605	29	20	654
Penang	196	4	26	226
Kedah	0	2	2	4
Total	8974	3155	912	13041

Table 2

Number of specimens of contraceptive usage and type of medical facility

Contraceptive	Type of Medical Facility			
	Family Planning Clinic	Government Hospital	Private Clinic	Total
"Pill"	6610	1096	215	7921
None	2-12	1871	680	4563
IUCD	252	108	14	374
Other	100	80	3	183
Total	8974	3155	912	13041

Table 3

Number of specimens, by contraceptive usage and race of patients

Contraceptive	Chinese	Indian	Malay	Total
None	2651	1042	281	394
Pill	4454	2948	274	7676
Total	7105	3990	555	11650

In addition, 61 specimens were unclassifiable due to technical causes, and 776 specimens were from patients whose age or race was unspecified or "other".

Chinese, Malay or Indian, the three major racial groups in Malaysia. As can be computed from Table 3, the percentages of specimens from Chinese, Malays and Indians were 69, 34, and 5, respectively. The estimated relative proportions of the three racial groups in West Malaysian females are 0.37, 0.52 and 0.10 respectively (Chander, personal communication).

As the incidence of cytological variations may differ among age, racial, and contraceptive usage groups, in Table 4 are given the number of specimens examined from the three major racial groups reporting either none or pill contraceptive, by 10-year age groupings. From Table 4, it can be seen that the percentage reporting no contraceptive usage increases in each older age group, with the exception of the Malay 21-30 age group. Also, the percentage reporting no contraceptive usage is least in Malays and greatest in Indians, with the Chinese always intermediate.

Although we have examined the records for those 396 specimens from which malignancy cannot be excluded (i.e. Class III, IV, and V) by searching for multiple specimens from a single individual, we have no practical way of checking all 13,045 records, at present. However, we feel that the remaining possible bias is very unlikely to be of such magnitude as to alter substantially conclusions which might arise from the data.

The optimum statistical inference strategy to follow in analysing these data were not apparent to us, because of two reasons. Firstly, the total number of statistical tests possible is so large that presentation of the results of all possible statistical hypothesis testing would be rather cum-

Table 4

Number of specimens by age and racial groups for patients using either pill or no contraceptive.

Age	Chinese			Malay			Indian			Total	
	Pill	None	% None	Pill	None	% None	Pill	None	% None	Pill	None
< 20	133	47	26	162	63	28	16	4	20	311	114
21 — 30	2121	929	30	1626	503	24	170	130	43	3917	1562
31 — 40	1856	1146	38	1056	386	27	77	103	57	2989	1635
41 — 50	340	423	55	103	74	42	11	32	74	454	529
> 50	4	106	96	1	16	94	0	12	100	5	134
Total	4454	2651	37	2948	1042	26	274	281	51	7676	3974

bersome; and secondly, as will be briefly discussed later, the precise population to which inferences would be made is not completely defined.

On the other hand, it seems desirable to utilise the power of statistical inference whenever possible. Therefore, our strategy was to provide in Table 8 the minimum differences required for significance (two standard errors which provides a significant level of 4.55% to be exact) in comparisons of two groups obtained by simple random sampling. For example, the difference between the per cent Chinese and per cent Malay age 21-30 reporting none contraceptive, 6 per cent (i.e., the difference between 30% and 24%, Table 4), is greater than two standard errors (i.e. 3.6%) for subgroups of size 1,000 for percentages around 20 (Table 8), and thus as these two groups, the Chinese and the Malay age 21-30, are also at least size 1,000 we conclude these two groups are significantly different from each other at least at the 4.55% level. Further comparisons of interest to the reader can then be made by using Table 8 as a quick approximation to the difference necessary for statistical significance between percentages computed from any two groups of the various respective sizes given.

Cytological classification

The specimens were processed and stained according to the Papanicolaou method. They were screened by primary screeners, checked by a senior cytotechnician, and finally by the cytopathologist. They were then classified essentially according to the International Standard (Seybolt, 1968) as follows:

Class I — Negative, with no abnormal cells detected;

Class II — Negative, abnormal cells present but considered to be of a non-malignant mature;

Class III — Inconclusive, abnormal cells present but malignancy cannot be excluded;

Class IV — Inconclusive, abnormal cells strongly suggestive of malignancy are present;

Class V — Positive, presence of abnormal cells which provide conclusive evidence of a malignant neoplasm.

Results and Discussion

In Tables 5, 6, and 7 are given the incidence of Class II, III and Class IV + V combined specimens, respectively, per 1,000 gynaecological specimens for the age, racial, and contraceptive groupings shown in Table 4. Alternatively, incidence rates per 1,000 can be considered as a percentage to the nearest tenth. If desired, the actual numbers of Class II, III, IV + V specimens observed are obtained upon multiplying the total numbers examined given in Table 4 by the various rates in Table 5, 6, and 7 respectively.

The observed Class II, III and IV + V incidences show a trend of increasing cytological abnormalities with age in all three races in both the pill and the none contraceptive groups (Table 5, 6, and 7). The incidnce of Class II specimens is greater in the Chinese than in the Malays in all age groups except the pill users under 21 (Table 5), while the incidence among the Indians fluc-

Table 5

Incidence of Class II (slightly abnormal) specimens per 1000 gynaecological specimens, by age and racial groups for patients using either "pill" or no contraceptive.

Age	Chinese		Malay		Indian	
	Pill	None	Pill	None	Pill	None
< 20	75	149	117	95	63	250
21 — 30	116	166	111	141	118	140
31 — 40	162	205	146	163	260	243
41 — 50	188	270	175	243	455	188
>50	250	340	0	125	—	500

Table 6

Incidence of Class III (definitely abnormal with malignancy not excluded) specimens per 1000 gynaecological specimens examined.

Age	Chinese		Malay		Indian	
	Pill	None	Pill	None	Pill	None
< 20	0	0	0	0	0	0
21 — 30	1	3	0	0	0	8
31 — 40	3	2	1	3	0	10
41 — 50	6	10	0	0	0	63
>50	0	28	0	125	0	0

Table 7

Incidence of Class IV + V (suspected or definitely malignant) specimens per 1000 gynaecological specimens examined.

Age	Chinese		Malay		Indian	
	Pill	None	Pill	None	Pill	None
< 20	0	0	0	0	0	0
21 — 30	0	1	0	0	0	0
31 — 40	1	4	0	0	0	0
41 — 50	6	0	0	0	0	31
>50	0	1	0	0	0	0

tuates both above and below the incidences of the other two racial groups. Although a few of these groups are too small to reach statistical significance by themselves, the near unanimity of the Chinese-Malay comparisons provide a rather clear indication of a real racial difference in the incidence of cytological abnormalities.

Although the causes of these observed racial differences in cytological variations are not yet clear, the importance of their elucidation is emphasised by the finding of Stern and Neely (1964) that 85% of cervical carcinomas had progressed through dysplasia of the cervix. Classification of high risk groups may include cultural, genetic, and sampling factors. For example, a higher risk of cervical cancer in the United States was associated with several factors, including lower socio-economic class, non-circumcision of sexual partners, and early first intercourse (Hammond, 1969). While socio-economic data are not generally available for the individuals in this study, we feel that the majority of both the Chinese and the Malays examined are of lower socio-economic class. Malay males are circumcised, while practically none of the Chinese are. On the other hand, more Malays than Chinese get married under age 21.

For another factor, Petrakis (1971) and Wallace et al. (1971) have recently suggested the existence of a genetic basis for two types of cancer, and we cannot exclude hereditary factors as being important in the racial variation of cytological abnormalities found in this study.

Differences among the races also occur with respect to the incidence of cytological abnormalities in the pill users as compared to the no contraceptive group. Within the Chinese, the no contraceptive groups clearly have an increased incidence of Class II specimens over the pill groups within each of the five age classes, and the same trend prevails among the Malays, with the exception of the youngest age group. Again, within the Indians, the trends are not so clear although in three of the five age groups the pill users suffer greater incidence of cytological abnormalities, and in a fourth group, there is no comparison possible because of zero observations. These observed racial differences could again be due to a number of causes, including both differences in the actual incidence in the populations as well as differences in diagnostic coverage. For example, Stern et al., (1971) found differences in the prevalences of dysplasia in a homogenous population even prior to use of the contraceptives.

A further point emerges from these data which is quite clear statistically but interpretationally seems rather obscure. Regardless of the racial and

Table 8

Two Standard Errors 1, 2 for Comparisons of Percentages from Two Groups of Various Sizes.

First Group Sizes	Second Group Sizes								
	4000	1000	300	100	80	50	30	20	10
	For Percentages around 1								
4000	0.4	0.6	1.2	2.0	2.2	2.2	3.6	4.4	6.4
1000		0.3	1.2	2.0	2.2	2.8	3.6	4.4	6.4
300			1.6	2.2	2.6	3.0	3.8	4.6	6.4
100				2.8	3.0	3.4	4.2	4.8	6.6
80					3.2	3.6	4.2	5.0	6.6
50						5.0	4.6	5.2	6.8
30							5.2	5.8	7.2
20								6.2	7.8
10									8.8
	For Percentages around 20								
4000	1.8	2.8	4.8	8.0	9.0	11.4	14.6	18.0	23.4
1000		3.6	5.2	8.4	9.2	11.6	14.8	18.0	25.4
300			6.2	9.2	10.0	12.2	14.4	18.4	25.9
100				11.4	11.8	13.8	16.6	19.6	26.6
80					12.6	14.4	17.0	20.0	26.8
50						16.0	18.1	21.2	27.8
30							20.6	23.0	29.2
20								25.2	31.0
10									35.8

First Group Sizes	Second Group Sizes								
	4000	1000	300	100	80	50	30	20	10
	For Percentages around 10								
4000	1.4	2.0	3.6	6.0	6.8	8.6	11.0	13.4	19.0
1000		2.6	4.0	6.2	7.0	8.6	11.2	13.6	19.0
300			4.6	7.0	7.6	9.2	11.4	13.8	18.2
100				8.4	8.6	10.4	12.4	14.6	19.8
80					9.4	10.8	12.8	15.0	20.0
50						12.0	13.8	15.8	20.8
30							15.4	17.2	21.8
20								19.0	23.2
10									26.8
	For Percentages around 50								
4000	2.2	3.4	6.0	10.2	11.2	14.2	18.2	22.4	31.6
1000		4.4	6.6	10.4	11.6	14.4	18.6	22.6	31.8
300			7.8	11.6	12.6	13.2	19.2	23.0	32.2
100				14.2	15.0	17.4	20.8	24.4	33.2
80					15.8	17.8	21.2	24.8	33.4
50						20.0	23.0	26.4	34.6
30							25.6	28.8	36.4
20								31.8	38.8
10									44.8

1 Equivalent to 4.55% significance level.
2 The standard errors were computed as $se = PQ\,(1/n + 1/n')^{\frac{1}{2}}$, where P = proportion "successes" in a population, Q = 1-P, n = sample size for one group and n' = sample size for the other groups.

age differences present, there is a lower incidence of cytological abnormalities in the pill users than in the no contraceptive group. However, we believe that such observed results should be treated with extreme caution because of the possibility that the pill and the no contraceptive groups are initially different. For example, Stern et al. (1971) found 45.2% of those choosing the pill had dysplasia prior to contraceptive usage, compared to 36.2% of the intra-uterine contraceptive device group with prior dysplasia.

To obtain evidence on this point, we examined 3,622 records that came to IMR in five randomly selected 2-week periods for some indication of gynaecological abnormalities or complaints prior to the clinic visit. The results were that 27.5% of the 2,613 specimens from contraceptive users (largely pill) had prior complaints, compared to 28.8% of the 1,009 no contraceptive group with prior complaints. Thus, these data provide little indication that a larger proportion of the no contraceptive group specimens resulted from individuals with a realised need for health care, as compared to the pill user group. However, we speculate that the family planning program may be providing generally better cancer and pre-cancer detection services to those whom it reaches, in addition to the other services the program provides and in similarity to the Barbados Island Family Planning Program (Cummins, 1969).

Summary and Conclusions

Based on 11,650 gynaecological specimens examined by the IMR Cytology Unit in 1970, the incidence of slightly abnormal specimens is greater in

1) 22 of 24 successively older, race by contraceptive groups;
2) 9 of 10 Chinese as compared to Malay age by contraceptive groups, with the Indians being generally intermediate but based on rather smaller numbers; and
3) 11 of 14 no contraceptive as compared to pill user age by racial groups.

Further, although the incidence of the more serious cytological variations are much lower and therefore show greater statistical fluctuation, the data available are generally consistent with the foregoing pattern of slightly abnormal specimens described above. Although some discussion regarding the causal factors of these observed cytological variations has been offered, much further work remains before any definitive conclusions can be reached.

References

Chander, R. Personal communication. Estimated population by state, race, and sex as of 31 December 1969. In "Population Statistics — West Malaysia". Government Printing Officer, Kuala Lumpur (in preparation).

Gummins, G.T.M. 1969. Cancer detection as part of a family planning program. Proceedings of World Conference on Cancer of the Uterus, New Orleans, La. 2-5, 1969: 76-79. **American Cancer Soc.**

Hammond, E.C. 1969. Identification of high risk groups cancer of the cervix. Proceedings of World Conference on Cancer of the Uterus, New Orleans, La. Mar. 2-5, 1969: 76-79. **American Cancer Soc.**

Petrakis, N.L. 1971. Some preliminary observations on the influence of genetic admixture on cancer incidence in American Negroes. **Int. J. Cancer, 7:** 256-258.

Seybolt, J.F. 1968. Thoughts on "The Numbers Game" **Acta Cytologica** 12: 271-273.

Stern, E., V.A. Clark and C.F. Coffelt. 1971. Contraceptive methods: selective factors in a study of dysplasia of the cervix. **Am. J. of Publ. Hlth. 61:** 533-558.

Wallace, D.C., L.A. Exton, and G.R.C. McLeod. 1971. Genetic factor in malignant melanoma. **Cancer 27:** 1262-1266.

Fractures of the cervical spine with minimal or no symptoms

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GROSS FRACTURE dislocations of the upper cervical spine have produced death. Those with less severe fractures have produced a tetraplegia. On the other hand, patients have come in with a tetraplegia but showing only minimal evidence of a probable dislocation.

This paper deals with cases showing very little, and in one case no symptoms and radiological suggestion of a fracture being only a chance finding.

Subsequent efforts at clearly localising the lesion and treatment employed is discussed.

Case I

An old male Indian doctor was talking to some strangers on a lonely road when he was struck unexpectedly from behind over the back of his head. He fell forward on his face. (It is not clear if he was struck subsequently). He sustained abrasions on the right side of his chin and upper lip. He also had contusions and tenderness on the anterior surface of his left shoulder and over his dorsal spine.

He had had a few drinks at a party and he was returning from it.

On examination, his general condition was good. He was conscious and rational and seemed to recall the incident reasonably well. No neurological deficit was noted. He complained of no pain, stiffness or tenderness in his neck. He was able to move it well. The radiographer subsequently mentioned

that when he rotated his head to the extreme right to take a lateral of the skull, he had pain on the left side of his neck.

In the lateral view of the skull, which included the upper cervical vertebrae, the crack in the left pedicle of C3 vertebra was noted. Re-examination of the patient revealed tenderness on deep pressure over the C2 C3 vertebrae lateral to the mid-line, greater on the left than on the right. AP, lateral, flexion, extension views of the cervical spine showed no lesions. The coned oblique view showed the opening of the left apophyseal joints and the fracture line on the pedicle extending into the body. The lesion appears to be an opening out of the apophyseal joints of C2 and C3 with fracture of the pedicle of C3. He was given a collar, and analgesics.

Case II

Female. Age 23; housewife (English).

Slipped and overbalanced and, in the process, twisted her neck. She did not fall. Felt severe pain on the right side of the neck associated with stiffness. The pain was aggravated by movements of the head to the right. No neurological lesions whatever. General condition was good.

Fig. 1A: Lateral extension view showing no evidence of a fracture.

Fig. 1B: Lateral, flexion view: no evidence of fracture seen.

Slight tenderness over the back of the neck at about C2 C3 level. X-ray of the cervical spine shows a subluxation of the atlanto axial joint with a probable fracture of the medial aspect of the left side of the atlas.

This patient was admitted and put in a cervical collar for three days, then discharged home with a collar. She however, took it off after 2 - 3 days. She had stiffness of the neck for a few days more but felt better after it.

Since then, she gets stiffness of the neck whenever she bends down to look under things, as under a few minutes.

Case III

Female student. Age 20; Indian.

She was in a car travelling at about 30 mph

Fig. 1C: Left oblique view, showing fracture of the pedicle of C3 and subhixation of the C2 C3 apophyseal joint.

Fig. 2A: Lateral view of cervical spine.

when it skidded and rolled off the road, two days prior to being seen. No loss of consciousness and no external injuries. She complained of:

Pain in the neck of the upper part of neck and stiffness.

Pain on top of the right shoulder and the right side of the base of the neck.

There were no neurological signs, whatsoever, in the arms and legs. There was some numbness in the right occipital region and back of the upper part of the neck. An X-ray of the cervical spine, especially the left oblique view, showed a fracture of the pedicle extending into the body.

We gave her a cervical collar. She had this on for about three weeks and was told to discard it. She lives in Singapore and apparently is without symptoms.

Case IV

Male 47: Broker. Indian.

He was drinking at a party when he was punched on the jaw and fell backwards. He could not recall anything after that but was carried home. He was brought to hospital the next day because of pain and stiffness in the neck. Pain aggravated by movements of the neck. There was no disturbance in bowel or bladder function. All four limbs functioned well.

On Examination

Tenderness over the back of the upper part of the neck. There was spasm of the neck muscles. No sensory deficit. No loss of power in all four limbs.

Crutchfield tongs and traction for six weeks was done and Camps brace for three months afterwards. Since then union was good, and no symptoms appeared. Has discarded the brace now.

In the above four cases, the amount of force used had been small indeed. One does not commonly expect a fracture of the cervical spine following a blow on the head, much less with slipping and over-balancing. It is perhaps only in Case III that one cannot assess the amount of force with any degree of accuracy for anything can happen in an overturning car.

These two features of minimal trauma and symptoms may lead the doctor first seeing those cases into thinking that they are but a 'stiff neck'. It is surprisingly common to come across patients not being able to recall easily or who do not appreciate the importance of minor knocks to the head. A fall or having been in a car that was knocked from behind is usually elicited only on prolonged and detailed enquiry. In the first three cases, it was only with repeated X-rays and coned views that one detected the fractures. The routine AP, lateral and obliques did not show them up well. One had to take more X-rays to be convinced.

Fig. 3A: Lateral view of cervical spine.

Fig. 2B: AP view of C1 C3 area showing dislocation between C1 and C2.

All these cases, except Case IV, were given cervical collars to minimise movement and to give comfort.

Case II took it off in six days and Case III in three weeks on their own although they were instructed to wear it for six weeks.

Case I is still wearing it most of the time; it is now three weeks. I suggested wearing it for six weeks.

Discussion

One must consider if these cases will not develop chronic neck pain. One comes across, from time to time, patients who have suffered minor trauma to their neck, and sustained a 'stiff neck' for a few days, and then onwards have had pain in the neck, back of the head or shoulder for a long time. They seem to go from hospital to hospital with seemingly no relief of symptoms.

The presence of fractures close to the intervertebral foramina and disruption of the apophyseal joints would suggest that these lesions may be

Fig. 3B: Antero-posterior view of cervical spine.

attended by some morbidity in the future. Possibly with the development of osteophytes in the intervertebral foramina exerting pressure on the nerves, and as osteoarthritis in the apophyseal joints.

One very often gets a history from patients with a long-standing neck pain, that they sustained trauma of some sort to their neck and following which they had 'massage' or manipulation of some kind or other to their necks, to help the 'stiff neck' that ensued after their trauma. This brings to our mind the question whther this 'massage and manipulation' did aggravate the existing lesion.

A practical consideration that emerges from these cases is that anyone who has had a blow on the head, and who complains of a spasm or who has tenderness on deep pressure of the neck, should have their cervical spine X-rayed. These should include AP lateral and obliques. If doubt exists, coned views should be of benefit.

Boylston 1957, in discussing the radiological diagnosis of cervical subluxations, stresses the importance of oblique views in flexion and extension to reveal all abnormalities.

The morbid potentialities of recurrent subluxation in the cervical spine is well recognised, a particularly severe fracture of it being vertebral artery compression and its effects.

None of these cases has shown any such effects. They were, however, recognised as having lesions in their cervical spine and treated for it. The short period for which they had submitted to treatment is cause for some concern.

In the cases described, not only subluxations but also fractures of the pedicles have been detected. In Case I and VI, the fact that they had alcohol prior to trauma may have slowed their reflex protective muscular contraction.

Summary

Four cases, with relatively minor trauma to the head, are presented. They came with minimal symptoms of neck stiffness and tenderness on deep pressure only. X-ray studies showed fractures of the pedicles laminae and diastasis of the apophyseal joints. They were treated with immobilisa-

Fig. 3C: Right oblique view of cervical spine showing a fracture of the C3 pedicle.

Fig. 4A: Lateral view of upper cervical spine showing fracture of the laminae of C2.

Fig. 4B: Antero-posterior view of upper cervical spine.

tion, muscle relaxants and analgesics for an average of six weeks. Up to date, which is an average of five months, they have not complained of undue symptoms enough to seek medical treatment.

The question of what dangers massage and manipulation would produce in these patients, and whether these patients would become prey to neck pain is raised.

The value of X-ray studies in minor trauma to the head is noted.

References

1. Watson-Jones, 1955. Fractures and Joint Injuries. Edinburgh and London, 4th Ed. Vol. 2, p. 968.
2. Boylston B.F., 1957. **J. Bone Jt. Surg.,** 39 A, 1902.

Diagnosis of pregnancy in women attending the General Hospital, Ipoh, Perak

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Introduction

IN RECENT YEARS, there has been a widespread trend away from the biological tests for pregnancy. In its place, various slide tests have been introduced which are claimed to be more accurate and rapid than the traditional animal tests, e.g. latex agglutination-inhibition test, complement fixation and a precipitin technique.

In the tropics, kits for immunologic methods deteriorate more rapidly if not maintained under suitable conditions of refrigeration. This, in turn, affects the tests giving rise to false positives. Besides, the cost of immunologic tests is greater than the cost of biologic methods using the male toad in preference to other laboratory animals.

This paper reviews the results obtained by the examination of 85 specimens of urine from 73 patients with normal or disturbed pregnancies using the toad test, gravindex and prepuerin. The purpose of this investigation is to determine which of these tests gives an accurate indication of the state of pregnancy and whether or not the foetus is viable as opposed to the mere presence of placental tissue. One thousand other cases were examined using the toad test only and this test was found to provide reliable information of use to the clinicians except in under four per cent of cases where a confirmatory test was necessary using gravindex and/or prepuerin.

Review of Literature

Some three thousand years ago, the Egyptians attempted to diagnose pregnancy in the human by watering the seeds of wheat and other cereals with the urine of women. If these seeds germinated, the woman was considered to be pregnant. Hendriksen (1941) tried out this early Egyptian method and found that 75% were correctly positive and 85% correctly negative — a degree of accuracy which was no worse than many, and even better than some of the recent tests carried out within the last 40 years.

In 1928, Ascheim and Zondek demonstrated the presence of gonadotrophic substances in the urine of pregnant women and provided the basis for considering the placenta an endocrine organ. They called these substances prolan which was probably made up of several different fractions. It was not until 1938, however, that the hormone

(chorionic gonadotropin) was isolated from placental cells growing in tissue culture.

The early tests were mainly confined to the qualitative diagnosis of pregnancy but later, the quantitative estimation of the hormone was useful as an aid in the diagnosis of hydatidiform mole or choriocarcinoma.

The various tests used in the detection of pregnancy in recent years may be divided into (I) Biological tests, and (II) Immunological tests.

(I) Biological tests.

(a) Ascheim Zondek test: Five female immature white mice, 18 to 20 days old and weighing 5 grams to 7 grams, were used for this test. 0.4 ml. of urine were injected subcutaneously into each animal three times daily for two days for a total dose of 2.4 ml. One hundred hours after the first injection, the animals were killed and the ovaries examined for corpora lutea.

This test confirms the presence of human chorionic gonadotrophin in the urine. It is produced by the placenta and should be distinguished from pituitary gonadotrophin; the latter could also produce effects on the ovaries similar to that produced by the former, thereby giving rise to false AZ reactions. A year later, after the publication of Ascheim and Zondek's results, Professor F.A.E. Crew and Dr. B.P. Wiesner set up the first laboratory concerned with the diagnosis of pregnancy in Edinburgh. Over 800 Ascheim Zondek tests were carried out in this laboratory with an accuracy, based upon the clinical diagnosis, of 97.8% (Crew 1930).

Dilution or Semi-Quantitative Tests: These tests were done if the pregnancy was thought to be abnormal. Ascheim (1930) observed that women with hydatidiform mole excreted more chorionic gonadotrophin than women with normal pregnancies. Dilution tests provide additional information when attempting to differentiate between pregnancy, hydatidiform mole and chorionepithelioma. Dilution tests are most useful during the period of follow-up of these cases. Biological tests are less sensitive than immunological tests in detecting HCG activity in urine of cases of normal pregnancy and hydatidiform mole (Wide and Hobson, 1964).

(b) Friedman test: A mature female rabbit that has been isolated for 3-4 weeks is used. Ten ml. of urine are injected into the ear vein. At the end of 24 hours, the animal is anaesthetised and the ovaries examined for ruptured haemorrhagic follicles which indicates a positive reaction. Some of the animals show a positive result after 24 hours; if negative, the animals should be examined again after a further 24 hours for delayed reactions.

The animal may be used again at the end of six weeks, or it may be killed after one test. The prolonged animal husbandry, or the cost of acquiring new animals for regular use in the laboratory, has resulted in the test being replaced by the more recent conventional methods. Friedman and Lapham (1931) reported a 100% accuracy for the test after examining 92 specimens of urine from pregnant and non-pregnant women.

(c) Rat hyperaemia test: Two immature female rats are used. 5 ml. of urine are injected subcutaneously into each animal at least four hours subcutaneously into each animal at least four hours apart. The animals are killed the following day. A positive result is indicated by an enlarged and reddened ovary. A negative result is indicated by a small pink ovary. It is sometimes difficult to detect the degree of pink which is diagnostic of a positive test, and a high level of accuracy can only be maintained by skilled technicians experienced in reading the results. The end point of each test was read at 2, 6 and 24 hours after injection. The test had an accuracy of 87% at 2 hours and 99% at 24 hours (Zondek, Sulman and Black 1945). Berman (1956) has reviewed the literature on the many modifications of this technique.

(d) Hogben test. (Female South African Clawed Toad, Xenopus Laevis): Hogben (1930) showed that the injection of extracts of the anterior lobe of the ox pituitary (ALP) stimulated ovulation and oviposition in Xenopus laevis. These findings were later confirmed by Bellerby (1933), Shapiro and Zwarenstein (1934). At the Pregnancy Diagnosis Laboratory, Edinburgh, 350,000 Hogben tests were done between 1948 to 1964, based upon the subsequent clinical diagnosis in 71,000 tests. It was shown that this test had an accuracy of 99.3% (Hobson, 1966). A number of workers have not been able to maintain the toad in good condition and are, therefore unable to get consistent results. Also, as the female toad is less sensitive than other animals used in biological tests, the urine has to be concentrated by the method of Scott (1940) and this could be time consuming. If laboratory conditions are not standardised, the Xenopus will lay eggs spontaneously. An occasional false positive result is also obtained in women receiving chlorpromazine therapy as shown by Marks and Shackcloth (1963).

(e) Galli-Mainini test. (Male frog or toad test): Galli-Mainini (1947) showed expulsion of spermatozoa by this animal after an injection of urine from a pregnant woman. The test had an accuracy

of 94% to 95% and both false positive and negative reactions occurred.

II. Immunological tests.

Agglutination inhibition tests: Urine containing human chorionic gonadotrophin will inhibit agglutination of HCG sensitised red cells or latex particles by rabbit — anti HCG sera. Some urines contain substances which prevent the inhibition of agglutination by HCG. For this reason, a control test is always done. The control consists of formalin preserved erythrocytes, stabilised in normal rabbit serum but not sensitised with HCG. Agglutination of this control should always be inhibited by urines from pregnant and non-pregnant women. If agglutination still occurs, then non-specific agglutinins must be present and these can be eliminated by acetone precipitation of the urine. The precipitate is washed with ether and alcohol, dried and resuspended in a phosphate buffer solution. This solution is centrifuged, and the supernatant liquid is tested again.

Commercially prepared haemagglutination inhibition tests.

(a) Pregnosticon (Organon Laboratories Ltd): This test detects a concentration of 1000 i.u. HCG per ml. of urine, and is read by observing the pattern of sedimented cells. The accuracy of the test varies from 98.7% to 99.8%. False negative tests are due to:

(i) Low levels of HCG in the urine which is below the sensitivity of the test.
(ii) Certain unidentified substances in the urine which interfere with the test.
(iii) Non-specific antibodies in the urine.
(iv) Glassware contaminated with soap or other detergents.

(b) Prepuerin. (Burroughs Wellcome and Co.): The urine is filtered and dilutions of 1:5, 1:10 and 1:20 prepared with an isotonic borate buffer. A positive control and a negative control were set up with each test. After mixing, the test is left overnight before positive reactions can be read with certainty. A reaction is recorded as negative if agglutination has occurred in all the tubes containing urine and the test suspension. A positive reaction is one where there is no evidence of agglutination but the cells have collected at the bottom of the tube in the form of a button with a clear centre. The overall sensitivity of the test is not as high as that of pregnosticon. Using the prepuerin test a positive reading in a dilution of 1:5 indicates a urinary concentration of 1,000-2,500 i.u. per litre.

(c) Urinary chorionic gonadotrophin test: (Denver laboratories). This test is not as accurate as the above two and gives many false negative reactions.

(d) Ortho Gravindex — Slide test: Latex particles coated with HCG are used instead of sheep erythrocytes. One drop of antiserum is added to a black slide and this is mixed with one drop of urine to be tested using an applicator stick and mixing for 30 secs. A drop of the latex particle suspension is then added and the slide gently rotated for two minutes at which time the reading is taken. If agglutination occurs, there is no evidence of pregnancy. It there is no agglutination, the test is positive, i.e. the woman is pregnant.

This is a rapid test but many false negatives occur. If the test is positive i.e. no agglutination occurs, it is more difficult to read if the light is poor, and the latex particles themselves give a false impression of agglutination. If agglutination occurs, the end point is easy to read. The test is able to detect a concentration of 5000 i.u./litre of HCG in the urine. The best results are obtained between 41 and 109 days after the last menstrual period. Sato & Greenblatt (1965) found that 60% of false negative reaction occurred in early pregnancy, but there were no false positives.

Materials and Methods.

The tests routinely carried out at the pregnancy testing laboratory, Institute for Medical Research, Ipoh are the male toad test, Gravindex test (Ortho) and the Prepuerin (Burroughs Wellcome).

(1) The male toad test: The toad commonly found in Malaya and other countries of South-east Asia is Bufo Melanosticus which is readily available all the year round in Malaya. It is found in large numbers along rivers and adjacent swampy areas, particularly after a heavy rainfull. The male is identified by the yellowish-orange patch under the chin, and the inside fingers of the forelimbs are black on top. It also croaks fairly readily. They are easy to catch at night with the aid of a torch when they come out to feed on insects near street lamps.

Animal Husbandry.

Housing: They were kept in the rear yard in a brick enclosure 3 feet x 4 feet x 2 feet, the top being partly covered with planks to keep out the sun and partly with wire gauze to permit adequate ventilation and lighting, and at the same time to prevent their escape. There was water to a depth of 4 inches with a few stones to serve as islands on which the toads could rest. All

toads used for the tests (whether these were positive or negative) were released in the gardens surrounding the laboratory which is at a considerable distance from the collecting area. Animals were never kept in the tank for longer than 10 days as they were found to lose weight in captivity in spite of the diet being adequate. The tank is thoroughly cleaned once or twice a week.

Feeding: The animals were fed weekly or twice a week. The food consisted of earthworms, maggots, small quantities of boiled rice, and young sprouted beans. The maggots obtained from fish entrails were kept on the rest platforms in the tank until flies were attracted to lay their eggs.

Economy: The toad was the most economical animal available for use in the biological test as it was very easy to collect and the cost of feeding was very low. The collector was paid 30 cents (Malayan = 4d. sterling) for each animal, and at a cost of 30 cents, about 20 animals could be fed each week. Three toads were used in case some of the animals were insensitive. The cost of each test was approximately 90 cents (Malayan) — (14p sterling). About 10 tests were carried out each week.

Definite end point: The overall accuracy of the pregnancy test depends upon the clarity of the end point. With the toad test, the production of spermatozoa gives a definite end point easily recognisable and which does not require a high degree of skill in identification or carrying out the test.

Rapidity of Reaction: Most urines gave a positive reaction within ½ hour — 2 hours of injection. Toads, which were negative, were examined again at the end of 4 hours.

Urine: For the qualitative diagnosis of pregnancy, it had been the practice for several years to collect the untimed first morning specimen. Recently random specimens were accepted which were more convenient to the patient if she had not been instructed to collect the morning specimen, and the results were known sooner. Many of these patients came from considerable distances away and it was not always practical for them to bring their urine specimens with them. It was more convenient to collect a random sample on their arrival at the laboratory. No significant differences were found in the tests whether random or first morning specimens were used, provided fluid intake was reduced to a minimum. Further, there was less contamination and false results were avoided if the tests were done immediately after collection. No concentration techniques were used for the following reasons:

1. It was time consuming and there was a shortage of trained personnel.
2. In a preliminary survey carried out in this laboratory, it was found that similar results were obtained after concentration of the urine as after the injection of 5 ccs. of neat urine diluted with an equal volume of sterile physiological saline.

Some of the urine specimens killed the toad and the following procedure was adopted to minimise this:-

(a) The containers used for the collection of the specimens were thoroughly cleaned by boiling in plain water for 10 minutes and then rinsed in tap water, followed by distilled water. No soap or detergent should be used for the cleaning.

(b) All urines were refrigerated from ½ - 1 hour to allow precipitation of the phosphates and any other toxic substances which may be present.

(c) The urine was then filtered into a wide mouth test tube of 50 cc. capacity. All glassware were cleansed using the procedure mentioned above.

(d) Heavily contaminated specimens were rejected as these caused disturbances in the reading of the gravindex and prepuerin tests and were rather toxic to the toad.

(e) After filtration, an equal volume of physiological saline at room temperature was added and 10 ccs. of this diluted urine was injected intraperitoneally into the toad.

During the test, the animals were kept in separate containers. Three animals were used for each test. The containers were in the form of glass tanks measuring 10 in x 7 in x 6½ in. A drop of cloacal fluid was removed from each of the animals with a fine tip pasteur pipette, which was inserted into the cloaca and gently moved up and down. Sufficient amounts of cloacal fluid were produced within 60-90 secs. This was placed on glass slides and examined under the microscope for spermatozoa.

Site of Inoculation.

(1) **Dorsal lymph sac.** — Absorption was

slower and it was not possible to inject more than 3-5 ccs. of urine by this route. Also, the animal succumbed more readily to toxic substances in the urine if this route was used.

(2) **Hind limb.** — The skin is loose over this area and some of the fluid injected escaped through the perforation made by the needle. It was not possible to inject more than 5 ccs. by this route.

(3) **Intraperitioneal route.** — We have found this very satisfactory for the following reasons:

(a) The toad can easily tolerate the volume of 10 ccs. that was injected. After injection, the site was gently squeezed between the thumb and index finger thereby sealing the aperture made by the needle and preventing the escape of the injected fluid.

(b) A repeat 5 ccs. can be given at the end of 4 hours if the reaction was negative and the clinical history and examination were suggestive of pregnancy.

(c) The action on the testes was more direct and spermatozoa were produced in a shorter time than by any other route.

After injection, the animals were kept in dry tanks without any water so that no exchange of fluids will take place between the external and internal environment thereby preventing any loss in chorionic gonadotrophin. After the test was over, the animals were released far from the site of collection.

Gravindex Slide test (Ortho): Refrigerated and filtered urine was used for this test. All reagents and urine stored in the refrigerator were kept at room temperature for ½ hour before proceeding with the test, details of which have been described above.

There was a high incidence of false positive results with this test in this country. The main reason for this had been the inadequate refrigeration facilities, resulting in deterioration of the reagents, particularly when the test kits were ordered through the local dealers and supplies were stored under unsatisfactory conditions. When supplies were forwarded direct to the laboratory by the manufacturers under refrigeration, the results were found to be very satisfactory and false positives were reduced to a minimum. If the test was positive, no agglutination occurred, while negative reaction was associated with agglutination.

One disadvantage of this test was that traces of agglutination were sometimes difficult to detect. Considerable experience was required in reading the end points and deciding which test was positive and which was negative. The urine should be as fresh as possible with minimum bacterial contamination. All glassware should be scrupulously clean, and only those specially cleaned by the laboratory were used.

Prepuerin (Burroughs Wellcome): Fresh urine was used in the test after refrigeration and filtration and dilutions of 1:5, 1:10 and 1:20 were prepared with an isotonic borate buffer as described elsewhere in this paper. A positive reaction could be read in 4 hours but it was preferable to read the test overnight when there was no evidence of agglutination and the cells collected as a button at the bottom of the tube. The rack holding the test tubes should be subjected to as little disturbance as possible in order to reduce the incidence of false reactions to a minimum.

Results

Eighty-five specimens of urine were examined from 73 women of the three major races, i.e. Indians, Chinese, and Malays and they were followed up till the end of their pregnancies. Their clinical histories were variable and tests for the presence of human chorionic gonadotrophin were carried out for the following clinical conditions:-

(1) Diagnosis of pregnancy.
(2) Molar pregnancy.
(3) Threatened abortion.

In the past, diagnosis of pregnancy was done more by clinical examination than by laboratory methods. At present, both the medical profession and the laity wish to have results available immediately for various reasons. When the woman is receiving treatment for infertility, the first missed period would lead her to visit the obstetrician who may require a pregency test to confirm or disprove any findings suggestive of pregnancy.

In these cases studied, it was found necessary to examine more than one specimen of urine from a few of them. Many of the patients gave irregular histories of amenorrhoea and/or bleeding per vagina so that it was difficult to know the exact date of the last missed period. One of the possible causes of this irregularity in the menstrual cycle was probably the result of the indiscriminate and unsupervised ingestion of drugs used for birth control purposes.

As many of the cases were from rural areas, with inadequate means of communication, it was not possible to follow up more cases up to the time of termination of the pregnancies. In 64 cases, the three pregnancy tests gave similar results which confirmed that the patients were pregnant. However, in nine cases, the pregnancy tests gave contradictory results. The prepuerin test was found to be the most sensitive and also gave false positive

results. In cases of threatened abortion, the first indication that intra-uterine death had occurred was a negative toad test, while the gravindex and prepuerin tests continued to be positive. In two other cases, the toad test gave false negative results while the other two were positive and both these delivered normal children. In some cases of abortion, the prepuerin test showed a disagglutinated pattern with crenated edge and it was not possible to decide whether the test was positive or negative in experienced hands. In one case of inevitable abortion, the gravindex and prepuerin tests were positive three days after curettage while the toad test was negative.

In a separate series of one thousand cases, where the toad test only was used, the obstetrician reported an overall accuracy of 96%.

Although the number of cases studied were few, the results seem to suggest that no one test is adequate in the diagnosis of pregnancy, and that more than one test should be used. The claims made for the superiority of the prepuerin and gravindex tests over the toad test does not appear to be justified in terms of cost, interpretation of the results, and rapidity with which the tests may be performed.

Interpretation of results is an important feature in the use of pregnancy tests and the simplest to interpret is the toad test where a positive or negative case shows the presence or absence of spermatozoa respectively. In terms of cost, the toad test is the cheapest as the animals are available in any part of the country. The annual cost of gravindex and prepuerin approximates to about 30 per cent of the total annual recurrent expenditure of a clinical pathology department, if these tests are used routinely.

In many hospitals in the country, hospital assistants, with very little laboratory training, are required to be in charge of laboratories and the toad test is easy to perform under these circumstances.

In difficult cases, more than one pregnancy test may be used, otherwise the use of the toad test should provide reliable information in the vast majority of cases. In some cases of false negatives, the toad test should be repeated.

In cases of molar pregnancy, a positive toad test of 1:32 dilution of urine and above was considered diagnostic; with gravindex, the titre was 1:64 and above. According to the manufacturers, with the prepuerin test, a dilution greater than 1:400 was regarded with suspicion. The above titre should be persistently elevated after the 5th day of delivery before a presumptive diagnosis of molar pregnancy can be made.

Conclusion.

A preliminary survey was carried out, using three pregnancy tests, viz toad, gravindex and prepuerin. Under local conditions, the toad test did not appear to be significantly inferior to the other two. But in terms of cost, and availability of trained laboratory personnel to interpret these tests correctly, the toad test was preferable on account of the simplicity in performing and reading the test, and the decreased cost. Although false negatives occurred with the toad test, it never gave a false positive in our experience.

References

Aschheim, S. & Zondek, B. (1928) Schwangerschaftsdiagnose aus dem Harn. (Durch Hormonnachweis). **Klin. Wschr.** 7, 8.
as quoted by B.M. Hobson, J. Reprod. Fert. (1966) 12, 33-48.

Aschheim, S. (1930). The early diagnosis of pregnancy, chorionepithelioma and hydatidiform mole by the Aschheim-Zondek test. **Am. J. Obstet. Gynec.** 19, 335.
as quoted by B.M. Hobson, J. Reprod. Fert. (1966) 12, 33-48.

Bellerby, C.W. (1933). The endocrine factors concerned in the control of the ovarian cycle. I. Xenopus laevis as a test animal. **Bioche. J.** 27, 615.

Berman, R.L. (1956). A critical evaluation of biological pregnancy tests. **Am. J. Obstet. Gynec.** 72, 349.

Crew, F.A.E. (1930). Pregnancy Diagnosis Station. Report on first year's working. **Br. Med. J. i,** 993.

Friedman, M.H. & Lapham, M.E. (1931). A simple, rapid procedure for the laboratory diagnosis of early pregnancies. **Am. J. Obstet. Gynec.** 21, 405.

Galli-Mainini, C. (1947). Pregnancy test using the male toad. **J. clin. Endocr. Metab.** 7, 653.

Henriksen, E. (1941). Pregnancy tests of the past and present. **West. J. Surg. Obstet. Gynec.** 49, 567.

Hobson, B.M. (1966). Pregnancy Diagnosis. **J. Reprod. Fert.** (1966) 12, 33-48.

Hogben, L. (1930). Some remarks on the relation of the pituitary gland to ovulation and skin secretion in Xenopus laevis. **Proc. R. Soc. Afr.** 5, 19.

Marks, V. & Shackcloth, P. (1963). Tranquilliser and pregnancy tests. **Br. med. J. i,** 52.

Sato, T. & Greenblatt, R.B. (1965). Detection of early pregnancy. Immunologic test versus the rat hyperemia test. **Am. J. Obstet. Gynec.** 91, 31.

Scott, L.D. (1940). The concentration and detoxification of human urine for biological pregnancy diagnosis. **Br. J. expt. Path.** 21, 320.

Shapiro, H.A. & Zwarenstein, H. (1934). A rapid test for pregnancy on Xenopus laevis. **Nature,** Lond. 133, 762.

Sulman, F. & Black, R. (1945). The hyperemia effect of gonadotrophins on the ovary, and its use in a rapid pregnancy test. **J. Am. med. Ass.** 128, 939.

Clinical value of nerve conduction studies

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IT IS MORE than 20 years ago since Hodes, Larrabee and German (1948) measured the motor nerve conduction velocity for clinical diagnosis. Since then, nerve conduction studies are performed routinely in conjunction with clinical electromyography as they have been shown to be of proven value in the differential diagnosis of neuromuscular disorders. The procedure is simple and rapid. The result is also objective. Facilities for carrying out such studies are a recent introduction to this country. It is felt that a report of the examinations personally performed during a year's fellowship in the Department of Clinical Neurophysiology, Rikshospitalet, Oslo, Norway, will help to illustrate the usefulness and principles of these tests.

In 1852, Helmholt with his ingenious mechanical apparatus measured the conduction velocity of the human median nerve and obtained values corresponding to present day figures. Animal experiments by Erlanger and Gasser (1927) demonstrated the relationship between the conduction velocity and the diameter of the peripheral nerve and that different nerves with different nerve fibres vary in their conduction velocities. Erlanger (1927), Gasser and Grundfest (1939) showed that the conduction velocities in warmblooded animals were almost directly proportionate to the axon diameters of the nerve fibres.

Hodes, Larrabee and German (1948) proved the values of motor conduction studies in patients with peripheral nerve injury and hysterical paralysis. By stimulating a given nerve at two points and finding the latency difference to the muscle response, they were able to measure the conduction velocity. Later workers like Lambert (1956), Gilliatt and Thomas (1960), Gilliatt and Sears (1958) showed that nerve conduction velocity is slowed in localised nerve lesions, in polyneuropathies and peroneal muscular atrophy. They helped to establish the technique as a practical diagnostic tool. Dawson and Scott (1949) showed that it is possible to detect nerve potentials in the median and ulnar nerves evoked by distal percutaneous stimulation at the wrist. The evoked potentials were picked up by bipolar electrodes placed at the appropriate nerve at the elbow. The evoked response in this case is made up of an orthodromic sensory and antidromic motor response. Dawson (1956) showed that by stimulating the digital nerves in the fingers, a purely sensory potential could be obtained from the median or ulnar at the wrist.

In 1952, Norris, Shock and Wagman demon-

strated slowing of the conduction velocity with increasing age in adult life. Wagman and Lesse (1952) showed that in persons over 60 years old, there is a reduction of about 10% in the conduction velocity. Gamstrop (1963) has shown that in motor fibres at birth, the conduction rate increases from only about half that of adults to reach a maximum in early adolescence. The conduction rate is also affected by temperature. Henriksen (1956), Buchthal and Rosenfalck (1966) showed that the conduction velocity slows with cooling by 2-2.4 metres/sec. per degree centigrade.

Conduction velocity of normal human peripheral nerves varies from 40 to 70 metres per second. In newborn infants, the conduction velocity is about 27 metres per second and usually reaches adult values when the child is 2 to 5 years of age.

Method

Satisfactory apparatus is now readily available commercially. The principal components and their connections are represented by the block diagram, fig. 1.

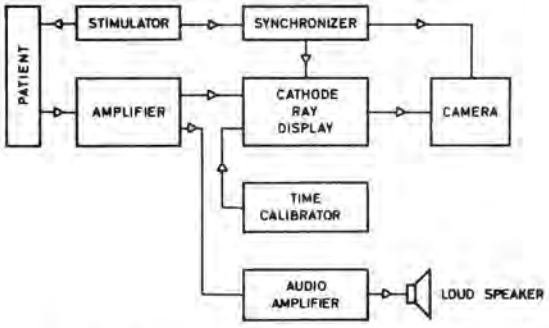

Fig. 1. BLOCK DIAGRAM OF AN ELECTROMYOGRAPH

The stimulator is designed to give a brief condenser shock, a square wave type of stimulus, with a duration of 0.1 msec. to 0.5 msec. Stimulus artifact is reduced either by a transformer or radio-frequency isolating unit.

The stimulation may either be bipolar or monopolar. The stimulators have round padded electrodes moistened with saline. For stimulating the digital nerves of the fingers, Dawson recommended small pliable silver strips two to four mm. wide covered by lint, moistened with saline and firmly applied to the fingers.

For motor nerve conduction, either a surface or concentric needle recording electrode may be used. The former electrode usually consists of silver or solder disc placed over the muscle and is especially advantageous in children. However, for distinguishing damage to one of the smaller terminal branches of the median or ulnar nerve, a needle electrode is needed. For sensory nerve conduction, surface electrode or a needle electrode may be used.

It is essential for the sweep of the cathode ray tube (oscilloscope) to be triggered by a stimulus after a suitable delay. The action potential, picked up by the recording electrode, is displayed on the oscilloscope and is also heard via a loudspeaker arrangement. The action potential on the oscilloscope screen is also photographed for permanent record and further analysis. A time marker with 1 msec. divisions is superimposed on the trace.

The time from the stimulus to the response is measured from the photograph. Alternatively, a special device which causes a vertical deflection of the horizontal axis of the oscilloscope trace, available commercially, permits direct measurement of the time latency on the oscilloscope. This value is read off from a digital counter, which records as the deflected baseline is moved from the stimulus to the response.

In the procedure, the patient is suitably earthed with a plate type electrode; where possible, it is placed between the site of stimulation and the pick up electrodes, so as to decrease the stimulus artifact.

In determining the motor conduction velocity of the median or the ulnar nerve, the recording surface electrodes are placed with the active electrode over the belly of the small muscle of the hand, with the reference electrode over the tendon of the muscle. With a needle electrode, it is inserted into the muscle. Stimulus is delivered to the nerve at the wrist, elbow, and axilla, usually at the rate of one per second and the latency time recorded accordingly. The distance for each latency is then measured.

The conduction velocity is calculated as follows. (See Fig. 2.)

In the sensory nerve determinations, the author determines the antidromic sensory velocity. The recording surface electrodes are silver strips placed firmly round the fingers at a suitable distance apart. Stimulus is again applied on the nerve on the sites used for determining motor conduction velocity. When the sensory response is small, better visualisation can be achieved by superimposition of many sweeps on a photograph. Other devices for increasing the signal to noise ratio could be obtained by electronic averaging of multiple sweeps.

The method of measuring the conduction velo-

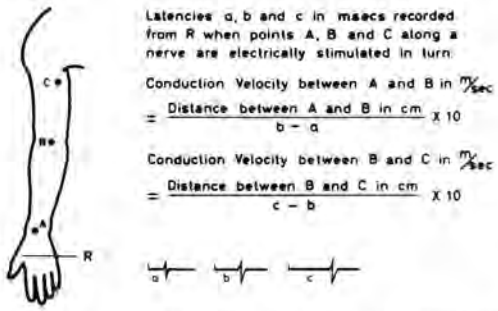

Fig. 2. DIAGRAM OF MOTOR STIMULATION AND RESPONSE AND METHOD OF CALCULATION OF NERVE CONDUCTION VELOCITY.

city of the lower limbs follows a similar technique.

Results

Out of a total of 110 clinical electromyographic examinations performed personally, 70 of the examinations were accompanied by nerve conduction studies.

In all the examinations, the motor nerve conduction velocity was measured. In about 20% of these, antidromic sensory conduction velocity was tested as well. A total of 112 determinations were performed on the 70 patients. 26 patients had abnormal conduction velocities.

Nerves	*Number*	*Number Abnormal*	*Percentage*
Median	29	10	34
Ulnar	33	6	18
Lateral Popliteal	28	10	35
Posterial Tibial	5	3	60
Facial	17	7	41
Total	112	36	32

In this series of examinations, the majority with abnormal conduction velocity correlated with clinical findings.

Case Reports

M.G., a 61-year-old married woman, was found to have cancer of the left breast and undergone a radical mastectomy 3 years ago. Six months prior to being seen, she started to complain of numbness and paraesthesia of the left hand, especially over the radial aspect. Examination revealed hypalgesia over the thumb. There was no evidence of metastatic recurrence of cancer. Electromyography of the hand muscles showed a few fibrillation potentials localised to the abductor pollicis brevis and a reduced interference pattern. Motor conduction velocity study showed a prolonged distal delay of 5.2 msec. (normal not more than 4.2 msec.) for the left median nerve, which had a normal proximal velocity. The conduction velocity of the left ulnar nerve was normal. These findings pointed to a Carpal Tunnel syndrome rather than a metastatic involvement of the plexus as originally feared.

G.S., a 50-year-old married male, a carpenter, complained of weakness of his left hand for the last five months. He had been in the habit of using his palm to drive chisels. There was no sensory disturbance. Physical examination revealed wasting and weakness of the right first dorsal interosseous muscle. No sensory changes were detected. Routine investigations, including radiological examination of the cervical spine, were normal. A provisional diagnosis of injury of the deep branch of the ulnar nerve was made. Electromyography showed evidence of neurogenic lesion affecting the muscles innervated by the deep branch of the ulnar nerve. Conduction velocities of the median and the ulnar nerves were as follows:

Nerves	*Median*	*Ulnar*
Distal Delay to 1st. Dorsal Interosseous	—	6.2 msec.
Distal Delay to Hypothenar Group		3.6 msec.
Distal Delay to Abductor Pollis Brevis	3 msec.	
Conductor velocity		
Axilla to Elbow	56m/sec.	55m/sec.
Elbow to wrist	70m/sec.	60m/sec.

Only the distal delay of the ulnar nerve to the first dorsal interosseous muscle was prolonged. It confirmed the diagnosis of injury of the deep branch of the ulnar nerve, a benign condition compared to amyotrophic lateral sclerosis which was the other diagnosis suggested.

K.K., a 74-year-old female, since one year ago complained of numbness and paraesthesia of the fingers of both hands, which she was unable to localise. Later the symptoms became worse. She also began to have vague aches and pains of the shoulders and elbows, especially at night. She dropped things at times. Examination revealed wasting and weakness of the thenar muscles. There was slight impairment of sensation over the thenar eminences and the lateral three fingers of both hands. X-ray of the cervical spine showed moderate cervical spondylosis. Electromyography showed fibrillation and positive dener-

vation potentials in both abductor pollicis brevis. Nerve conduction velocity study showed a prolonged distal delay of 7.5 msec. and 9.6 msec. for the left and right median nerves respectively as compared to a normal distal delay of not more than 4.2 msecs. A firm diagnosis of bilateral carpal tunnel syndrome was made and surgical treatment performed with good results.

W.S., a 40-year-old male working as a labourer, noticed gradual weakness of his left leg 6 months ago. His left foot began to catch the ground recently. As a result, he walked with a limp. There was no sensory symptoms. Five years ago, he had a car accident, but there was no serious injury, except he began to have pains on the lumbar spine now and then. Clinical examination revealed a left foot drop. There was weakness and wasting of the muscles innervated by the lateral popliteal nerve. No sensory loss was detected Myelography showed no abnormality. Electromyography and conduction study showed partial palsy of the left lateral popliteal nerve with a prolonged conduction velocity for the ankle-knee segment of the nerve, while the distal delay and the conduction rate for the popliteal fossa-knee segment of the nerve were normal. These findings were more in favour of a lateral popliteal nerve palsy instead of root compression syndrome from disc protrusion of the lumbar spine.

S.A., a 16-year-old schoolgirl, in 1968 began to have progressive weakness of the lower extremities. She found it difficult to walk. There were no sensory symptoms. No other members of the family had a similar illness. Clinically, she had bilateral atrophy and weakness of the foot muscles and the anterior tibial and posterior tibial muscles of the legs. The small muscles of the hands, especially the first dorsal interosseous muscles, were atrophied and weak. No objective sensory loss was detected. Laboratory investigations, including C.S.F. and enzyme studies for muscle disease, were normal. Electromyography showed evidence of a neurogenic lesion affecting the distal group of muscles of the lower extremities and the muscles of the hands. Conduction velocity study performed showed the following:

Nerves		
Left Lateral Popliteal (motor)	Knee to Ankle	30m/sec.
	Distal Delay	15.2 msec.
Left Posterior Tibial	Knee to Ankle	23m/sec.
	Distal Delay	8.4 msec.
Sensory	Distal Delay	11.2 msec.
Right Ulnar (Motor)	Axilla to Elbow	56m/sec.
	Elbow to wrist	44m/sec.
	Distal Delay	4.8 msec.

The result showed that the conduction rates of the left lateral popliteal, the posterior tibial and the right ulnar nerve were prolonged. The findings indicated a diagnosis of a chronic peripheral neuropathy which affected the lower limbs more than the upper limbs.

Discussion

The motor unit is a physiological concept, which consists of the motor neuron, its axon, the neuromuscular junction, and motor fibres, which the nerves innervate. The number of muscle fibres per motor unit varies from a few in the extraoccular muscles to about two thousand in some of the muscles of the lower limbs. (Feinstein, Lindergaard, Nyman and Wohfart, 1955) Fig. 3.

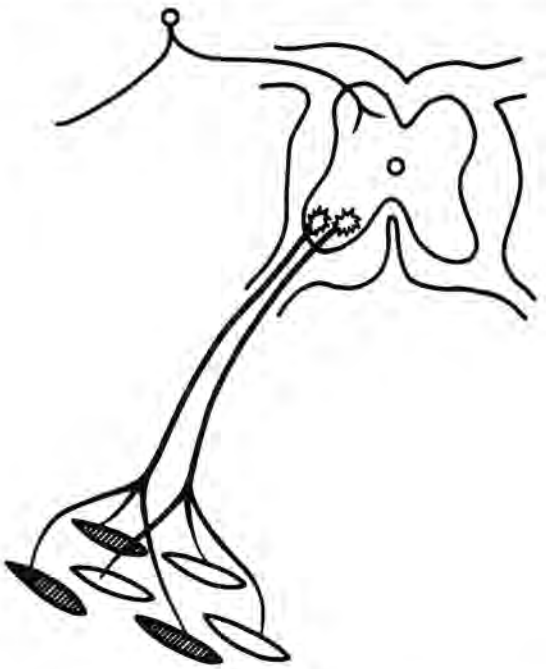

Fig. 3. TWO MOTOR UNITS

Neuropathic lesions of the motor unit can affect either the anterior horn cell or the nerve fibre, anywhere along its course. Myopathic lesions involve the neuromuscular junction or the muscle fibres. In the majority of patients, clinical electro-

myography easily distinguishes the myopathic lesion from the neurogenic lesions. When the peripheral neuropathy affects mainly the motor components of the nerve fibres, it may be difficult to distinguish this from a chronic myopathic lesion clinically and with electromyography. Motor nerve conduction study may be of great help on such occasions. With electromyography alone, it is often difficult to separate those neuropathic conditions affecting primarily the nerve fibres (Case 5) from those affecting the lower motor neuron. Conditions such as poliomyelitis, amyotrophic lateral sclerosis and other spinal cord lesions do not alter the nerve conduction velocity appreciably. Infective polyneuropathy, diabetic neuropathies, pressure and traumatic neuropathies causing damage to the peripheral nerves decrease the nerve conduction velocities.

Measurement of the nerve conduction velocity is a relatively simple and quick method of differentiating the two groups of neurogenic lesion. Localised lesions along a nerve can be frequently identified and localised with this technique. Examples of such localised lesions are the compression of the median nerve beneath the flexor retinaculum at the wrist producing the carpal tunnel syndrome, and pressure of the ulnar nerve at the wrist or at the elbow. At the level of the wrist, if the deep branch of the ulnar nerve is affected, the sensory conduction velocity to the little finger is not affected. In carpal tunnel syndrome (Cases 1 and 3) or in a lesion of the deep branch of the ulnar nerve (Case 2), the distal delays from the wrist to abductor pollicis brevis and the first dorsal interosseous muscle respectively are prolonged. In localised neuropathies at the sites, such as the pressure of the ulnar nerve at the elbow or pressure of the lateral popliteal nerve at the neck of the fibula (Case 4), stimulating proximal to the lesion will give reduced conduction times. Stimulation, distal to the lesion, will reveal a normal nerve conduction velocity.

In lesions of the brachial plexus and the cervical roots, differentiation is more difficult. The presence of normal evoked sensory potential of the median and ulnar nerve after a traction injury of the brachial plexus is suggestive of the roots being avulsed (Bonney and Gilliatt, 1958). Diseases of the spinal cord generally do not decrease the nerve conduction velocities, (Henriksen, 1956; Gilliatt, 1961; Ertekin, 1967).

In polyneuropathy of varying etiology such as infective, toxic, nutritional, metabolic and hereditary neuropathies, the nerve conductions may be prolonged. Chronic neuropathies, like peroneal muscular atrophy and hypertrophic polyneuropathies, may have marked slowing of the nerve conduction, (Dyck, Lambert and Mulder, 1963; Thomas and Lascelles, 1967). In diabetic neuropathy, studies by Mulder, Lambert, Bastron and Spraque (1961), in 108 diabetic patients, showed that nerve conduction velocities are slowed not only in those with clinical neuropathy but also in some without clinical evidence of the neuropathy. Others, like Lawrance and Locke (1961), Downie and Newell (1961), have confirmed these results.

Conclusion

Studies of the nerve conduction velocity have become an integral part of clinical electromyography. The technique is simple and rapid. It is reliable and useful to physicians and surgeons alike. The studies provide objective values and they therefore facilitate the management of patients with neuromuscular disease. They may also be of help in functional disorders seen in clinical practice and in medico-legal situations.

References

Bonney, G. and Gilliatt, R.W. (1958). Sensory nerve conduction after lesion of the brachial plexus. **Proc. Roy. Soc. Med.** 51, 365.

Buchthal, F. and Rosenfalck, A. (1966). Evoked action potentials and conduction velocity in human sensory nerves. **Brain Research, special issue.** Elsevier Publishing Company, Amsterdam.

Dawson, G.D. (1956). The relative excitability and conduction velocity of sensory and motor fibres in man. **J. Physiol. (Lond.),** 131, 436.

Dawson, G.D. and Scott, J.W. (1949). The recording of nerve action potentials through the skin in man. **J. Neurol. Psychiat.,** 12, 259.

Downie, A.W. and Newell, D.J. (1961). Sensory nerve conduction in patients with diabetes mellitus and controls. **Neurology** (Minneap.) 11, 876.

Dyck, P.J., Lambert, E.H. and Mulder, D.W. (1963). Charcot-Marie-Tooth disease: Nerve conduction and clinical studies of a large kinship. **Neurology** (Minneap.), 13, 1.

Erlanger, J. and Gasser, H.S. (1927). Compound nature of action current of nerve as disclosed by cathode ray oscilloscope. **Am. J. Physiol.,** 70, 624.

Erlanger, J. (1927). Interpretation of action potential in cutaneous and muscle nerves. **Am. J. Physiol.,** 82, 644.

Ertekin, C. (1967). Sensory and motor conduction in motor neuron disease. **Acta Neurol. Scand.** 43, 499.

Feinstein, B., Lindergard, B., Nyman, E. and Wohlfart, G. (1955). Morphologic studies of motor units in normal human muscles. **Acta anat. (Basel),** 23, 127.

Gamstrop, I. (1963). Normal conduction velocity of ul-

nar median and peroneal nerve in infancy, childhood and adolescence. **Acta Paediat. Suppl.,** 146, 68.

Gasser, H.S. and Grundfest, H. (1939). Axon Diameters in relation to spike dimensions and conduction velocity in Mammalian Fibres. **Am. J. Physiol.,** 127, 393.

Gilliatt, R.W. in Licht, S. (1961). 'Electrodiagnosis and Electromyography'. (Elizabeth Licht, New Haven, Connecticut).

Gilliatt, R.W. and Sears, T.A. (1958); Sensory nerve action potentials in patients with peripheral nerve lesions. **J. Neurol. Psychiat.,** 21, 109.

Gilliatt, R.W. and Thomas, P.K. (1960). Changes in nerve conduction with ulnar lesions at the elbow. **J. Neurol. Psychiat.** 23, 312.

Henriksen, J.D. (1956). Conduction velocity of motor nerves in normal subjects and patients with neuromuscular disorders. M.S. (Phys. Med.) Thesis, University of Minnesota.

Hodes, R., Larrabee, M.C. and German, W. (1948). The human Electromyogram in response to nerve stimulation and the conduction velocity of motor axons. **Arch Neurol. Psychiat. (Chicago),** 60, 340.

Lawrence, D.C. and Locke, S. (1961). Motor nerve conduction velocity in diabetes. **Arch. Neurol. (Chicago),** 5, 483.

Mulder, D.W., Lambert, E.H., Baston, J.A. and Sprague, R.G. (1961). The neuropathies associated with diabetes mellitus. **Neurology (Minneap.)** 11, 275.

Norris, A.H., Shock, N.W. and Wagman, I.H. (1953). Age changes in the maximum conduction velocity of motor fibres of human ulnar nerves. **J. appl. Physiol.,** 5, 589.

Thomas, P.K. and Lascelles, R.G. (1967). Hypertrophic Neuropathy, **Quart. J. Med.,** 36, 223.

Wagman, I.H. and Lesse, H. (1952). Maximum conduction velocities of motor fibres of ulnar nerve in human subjects of various ages and sizes. **J. Neurophysiol.,** 15, 235.

The sensitivity of Staphylococci to antibiotics

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STAPHYLOCOCCI, more than other types of micro-organisms, have been able to develop protective antibiotic resistance (Mitsuhashi, 1967). As a result, many strains, particularly those found in hospitals, are now resistant to the commonly used antibiotics.

Staphylococci often produce characteristic lesions which can be recognised clinically, and supporting evidence may be obtained by Gram staining material from the lesions. However, the sensitivities of the causative organisms cannot be known for 24 hours or longer, so initial treatment must be based on a knowledge of the pattern of sensitivities of the organisms in the locality.

In this paper, we give the results of **in vitro** tests of antibiotic sensitivities to staphylococci isolated in the Department of Bacteriology, University of Malaya, during 1971.

Methods

Collection of data

The data from the University Hospital were taken from the day books in the Department of Bacteriology. The 1969 series was part of a larger study of antibiotic sensitivities. The 1971 in-patient series were isolations made during October, November and December, 1971. The out-patient series were organisms isolated from July to December, 1971. All staphylococci isolated, with the exception of those cultured from urine, were included. The organisms isolated from urine were excluded because the antibiotic discs used to test urinary organisms differed in strength from the other discs.

The data from the School Health Service were obtained from nose and throat swabs taken from schoolchildren at schools in Petaling Jaya, as part of a study into the frequency of pathogenic organisms in this group of children.

Laboratory methods

Specimens were taken on sterile cotton-tipped swabs which were cultured on 5% human blood agar plates and incubated at 37°C, both aerobically and anaerobically. Colonies, which morphologically resembled staphylococci, were Gram stained and a slide coagulase test was performed. Antibiotic sensitivities were tested on all coagulase positive cultures. The colonies were suspended in 2 ml. of sterile broth which was incubated for 2 to 3 hours. A petri dish containing diagnostic sensitivity testing agar (DST — Oxoid) was flooded with the broth, any excess pipetted off and the plate allowed to

dry. Filter paper discs impregnated with antibiotic (Mast Laboratories) were then placed firmly on the agar and the plate incubated at 37°C overnight. Antibiotic sensitivity of a standard strain of known staphylococcus of known sensitivity (Oxford staphylococcus) was also done at the same time as a control. The concentration of antibiotic in each disc was:—

Penicillin G	4 units
Methicillin	5 microgrammes
Cephaloridine	5 microgrammes
Chloramphenicol	25 microgrammes
Streptomycin	10 microgrammes
Tetracycline	25 microgrammes
Kanamycin	30 microgrammes
Trimethoprin-sulpha	25 microgrammes
Gentamycin	10 microgrammes

The density of the growth and the size of the zone of inhibition of the organisms under test was compared with that of the standard control, and the results reported as follows:

Zone of inhibition around test organism compared with standard organism	Report	Significance
greater than $\frac{3}{4}$	Sensitive	Sensitive
between $\frac{1}{2}$ and $\frac{3}{4}$	Moderately sensitive	May be partly resistant, a higher dose of antibiotics may be needed
less than $\frac{1}{2}$	Resistant	Resistant

In the results which follow, sensitive organisms were classed as sensitive, while moderately sensitive and resistant organisms were classed together as resistant.

Results

The sensitivities of the staphylococci to various antibiotics are shown in Table 1.

From this table, it can be seen that:—

1. The percentage of staphylococci resistant to penicillin varies among the groups. The resistance is highest among the 1971 inpatient series; the percentage resistant is significantly less among the 1971 out-patient series (X^2 5.57 with 1 d.f. $0.2 > p > 0.1$) and is lower again in the Petaling Jaya schoolchildren (X^2 25.50 with 1 d.f. $p < 0.001$). There has been no significant change in the

Table 1:
Antibiotic Sensitivities of Staphylococci

Antibiotic	University Hospital 1969 Inpatients & Outpatients			University Hospital 1971 Inpatients			University Hospital 1971 Outpatients			Petaling Jaya School Health Service 1969		
	Sens.	Resist.	% Resist.	Sens.	Resist.	% Resist.	Sens.	Resist.	% Resist.	Sens.	Resist.	% Resist.
Penicillin	199	193	62	62	133	68	54	66	55	122	38	24
Methicillin	303	13	4	142	4	3	110	1	1	**	*	*
Chloramphenicol	159	33	17	165	27	14	105	17	14	149	11	7
Streptomycin	180	136	43	98	54	35	98	14	12	91	69	43
Tetracycline	94	135	59	103	89	46	69	55	44	123	37	23
Kanamycin	103	8	7	*	*	*	*	*	*	61	0	0
Cephaloridine	312	3	1	*	*	*	*	*	*	160	0	0
Sulpha-trimethoprim	*	*	*	189	4	2	*	*	*	*	*	*
Gentamycin	*	*	*	185	6	3	*	*	*	*	*	*

*Data not available.

Table 2
Resistance of Staphylococci, 1967 and 1971

Antibiotic	In-patients		Out-patients	
	Soo-Hoo & Chai Univ. Hospital 1967 % Resistant	Present Series Univ. Hospital 1971 % Resistant	Soo-Hoo & Chai Univ. Hospital 1967 % Resistant	Present Series Univ. Hospital 1971 % Resistant
Penicillin	37	68	61	55
Streptomycin	5	35	14	12
Tetracycline	37	46	54	44
Methicillin	5	3	6	1

percentage of resistant organisms among in-patients from 1969 to 1971. (X^2 2.10 with 1 d.f. p 0.2).

2. Less than 5% of the staphylicocci isolated in the hospital were resistant to methicilin, and this percentage has not changed from 1969 to 1971.
3. Resistance to chloramphenicol is about 15% in hospital patients, but is only 7% in the schoolchildren in Petaling Jaya.
4. The resistance of staphylococci among in-patients has remained constant from 1969 to 1971 (X^2 2.40 with 1 d.f. $p > 0.2$). Among the out-patients, resistance to streptomycin is much lower, but the schoolchildren showed a surprisingly high percentage of resistant organisms.
5. Analysis shows that only 66% of the staphylococcal infections found in hospital would be sensitive to the penicillin-streptomycin combination which is used particularly in wound infections.
6. Resistance to tetracycline has decreased within the hospital from 1969 to 1971 (X^2 6.66 with 1 d.f. $p < 0.01$) and is less common among schoolchildren.
7. No recent data for the resistance to kanamycin and cephaloridine are available for hospital patients, but the low level of resistance in the 1969 series and also among the schoolchildren suggests that most organisms are sensitive.
8. In the 1971 in-patient series, only 2% of the staphylococci were resistant to sulphatrimethoprim mixture (Bactrim, Roche, Septrin, B.W.) and only 3% were resistant to gentamycin.

Discussion

Our findings show that there has been little change in the antibiotic resistance of staphylococci since 1967 when Soo-Hoo and Chai collected material from the University Hospital (Soo-Hoo & Chai, 1969). A comparison between the two sets of data is shown in Table 2.

(Table 2 here)

The only significant changes have been in the increasing resistance to penicillin G and streptomycin among hospital in-patients.

In vitro tests should be used as a guide to antibiotic therapy, but clinical factors may modify the choice of antibiotic (Ericsson & Anderson, 1967). From the results of the **in vitro** tests reported here, the following antibiotics may be suitable for use in staphylococcal infections. The drug actually chosen will depend on the severity of the infection, the route of administration and the risks of anaphylaxis and toxicity.

Recommended antibiotics for staphylococcal infection

Oral administration

- Sulphamethoxazole-Trimethoprim combination
- Methicillin derivatives
- Chloramphenicol

Parenteral administration

- Methicillin
- Cephaloridine
- Chloramphenicol

Reserve antibiotics

Kanamycin
Gentamycin

Summary

The **in vitro** sensitivities of staphylococci isolated in the University Hospital and among schoolchildren in Petaling Jaya have been analysed. There have been few changes in the last four years. Suggestions are made for the use of antibiotics in staphylococcal infections.

Acknowledgement

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References

Ericsson, H. & Anderson, G. (1963) "Present Status of International Standardisation of Techniques for Antibiotic Susceptibility Tests". 3rd International Congress of Chemotherapy, Stuttgart. pub. Georg Thieme Verlag, Stuttgart.

Lorian, V. (1966) "Antibiotics and chemotherapeutic agents in clinical and laboratory practice". pub. Charles C. Thomas, Springfield.

Mitsuhashi, S. (1967) "Epidemiological and genetic study of drug resistance in staphylococcus aureus". **Jap. J. Microbiolog., 11,** 49.

Soo-Hoo, T.S. & Chai, K.H. (1969) "Antibiotic resistant staphylococci isolated in the University Hospital from May 1967 to July 1968". **Med. J. Malaya, XXIV,** 145.

Therapeutic effects of sub-mucous diathermy of inferior turbinates, with special reference to ethnic groups in Malaya

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Introduction

THE COMPLAINT OF nasal obstruction, secondary to chronic rhinitis, is one of the commonest and sometimes the most perplexing problems faced by the rhinologists, specially in the tropics. This is not surprising when one considers the extent to which the nasal mucosa is exposed to the various types of insults in a person's everyday life. This is more so with modern industrialisation when there is extensive air pollution. Recurrent infection both acute and chronic, allergy, inhalation of dust, smoke and fumes, endocrine disturbances and indiscriminate use of nasal medication all tend to engorge and often enlarge the submucosa and the mucous membrane.

Anatomy and Physiology

In improving the air-way through the nose, several factors must be considered. They include:

(a) The path the air current takes through the nasal cavity.
(b) The anatomical structure of the nasal cavity.
(c) The rich blood supply.
(d) The various nervous control mechanisms.

Normally, the inspired air is directed to the roof, due to constriction 1 cm. from the anterior nares, "Constriction of Bell". It reaches to just below the superior turbinate. The air current is also deflected slightly inwards "20°" by the same constriction so that it ascends close to the septum. Deflected from the vault slightly back and down in a parabolic curve, the air current fans out as it approaches the choana. The expired air, which is "air-conditioned", follows a somewhat same course but due to the disproportion between the choana and anterior nares, a large eddy current is set up. This causes the expired air to enter the

meatii and ostea. According to Proetz (1963) "The pathway of air current is determined by three structural elements:

(a) Direction of the anterior nares.
(b) The essential configuration of the nasal chambers; and
(c) The relative sizes of the anterior and posterior nares"

In the average Caucasian nose, with a slit-like horizontal opening at the anterior nares, the inspired air arches high up into the nose in a parabolic curve before descending into the large opening in the nasopharynx. In Malaya, the Indians and the Malays have this nasal configuration to a greater or lesser degree while the Chinese have nostrils which are fairly dilated, circular, with a more flattened nasal-bridge. These are features not very unlike those of the Negroes in whom inspired air takes a more direct transverse course over the inferior turbinates (Tremble 1960).

The need for inspired air to be warmed and humidified calls for a very specialised vascular supply and, together with it, an intricate and sensitive nerve supply. The relative humidity of alveolar air is 90%, and 70% of this humidity is accounted for by the nasal cavity (Proetz 1963). Similarly, the temperature has to be raised to approximately 35°-37°C. That is, in one second "average time the inspired air takes to pass through the nasal cavity", the nose has to impart sufficient water vapour and heat to the inspired air to bring it to this physiological requirement (Ritter F. 1970). The blood vessels of the nose play an important role in this regulation. The nasal-angio architecture has been thoroughly studied by many since the classical study of Zuckerkandl nearly hundred years ago (Cuana and Hinder 1969; Ritter 1970; Cuana 1970; Dawes and Pritchard 1953).

Briefly, the sphenopalatine arteries supply the nasal septum and lateral wall of the nose below the middle turbinates with contributions from the ethmoidal, greater palatine and nasal branches of the facial arteries. The arrangements being arteriols-capillaries-sinusoids-venules. The sinusoids are surrounded by smooth muscle fibres giving it the power of vaso-constriction. Microscopically, there is a functional arrangement of the vessels of the nasal cavity, especially the turbinates. The minute arteriols course in parallel rows in a postero-anterior direction and lie in three distinct levels in relation to the mucosal surface (Ritter F. 1970):—

(a) Superficial level lying under the mucosa supplying respiratory epithelium.
(b) Second deeper level in association with mucous and serous glands among the loose connective tissue.
(c) Third deeper level adjacent to the osseous supporting frame work.

The vessels are supplied in main by:—

(a) Parasympathetic from the superior salivatory nucleus via the greater superficial petrosal nerve.
(b) Sympathetic from the intermedio-lateral of grey column of the spinal cord via the superior cervical ganglion.

These two components eventually form the nerve of the Vidian canal.

Apart from these, there is anatomical evidence to indicate that the sensory fibres that travel along blood vessels may be involved in local axon reflex. Also there is strong evidence that the nasal blood vessels are regulated by agents carried by the blood. These agents reach the muscular layer of the blood vessels via the endothelial lining and its porous basement membrane (Cuana N. 1970).

Thus, the control mechanism of the nasal blood flow is a complex one and hence the great difficulty in managing satisfactorily those patients with an unstable nasal vasculature in chronic vasomotor rhinitis.

Various methods have been tried to shrink the mucous membrane of the inferior turbinate in an attempt to improve the air way. One of them used by us is to destroy some of the large cavernous spaces by using sub-mucous high frequency dessication.

Material and Method

The selection of patients for this review consisted of all those subjected to this form of treatment between October '67-September '69. Their common symptom-complex was nasal obstruction of an alternating type, with episodes of sneezing and watery rhinorrhea. Definite allergic and infective cases were excluded. In all, 200 such cases were studied. They were followed up regularly at about 2-3 months intervals. At each of the visits, their progress was noted and recorded. At these visits, they were asked specifically whether the procedure gave any relief, and if so, was it complete or partial. In some patients, the procedure was repeated either because the patient requested for it or they felt partial relief of symptoms and that a repeat would have benefited them. The cases were followed up for an average of 12-18 months.

Birtcher Hyfrecator was used for the treatment of these patients. This is a simple device where, by use of a spark gap condenser circuit, a very high frequency damped current, of relative high voltage but of a low amperage is produced. This is suitable for electro-desiccation of tissue in surgical practice. Electro-desiccation by definition is a dehydration process rupturing the cell membrane and transforming it into a dry mass. For this purpose, a fine needle electrode insulated except for about an inch at the tip, is inserted submucosally into the nasal aspect of both inferior turbinates. A current of sufficient intensity judged by the amount of sparks emitted by the electrode tip when in contact with metal, which is usually between 25-50 as shown on the dial of the hyfrecator, is applied for about 20 seconds. This process is repeated at various points submucosally along the inferior turbinate (Fig. 1). The nasal cavities of these patients are previously anaesthetised with local application of 5% cocaine in 1:1000 adrenaline, or xylocane spray over nasal mucosa.

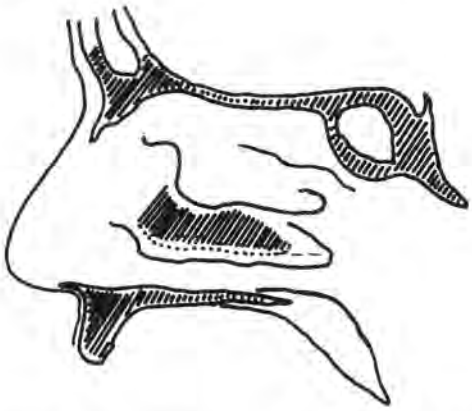

Fig. 1: Diagram shows sites of insertion of electrode along the Inferior Turbinates.

Results

The results were tabulated into three groups according to the duration of beneficial effect (partial or complete).

(a) Immediate — when relief of symptoms were up to 3 months from time of procedure.

(b) Temporary — when they were symptom free from 3-6 months.

(c) Permanent — when relief was from 6 months and over.

However, the longest period of follow-up in this series has been up to 20 months. The results were tabulated according to:

Ethnic Group — Table 1
Age Group — Table 2
Duration of beneficial effect in each ethnic group according to relief of symptoms. — Tables 3, 4, 5 and 6.

Table 1
Racial Incidence

Race	Sex		Total Number	Percentage
	Male	Female		
Chinese	96	52	148	74.0%
Indian	21	19	40	20.0%
Malay	5	4	9	4.5%
Others	2	1	3	1.5%
		Total	200	

Discussion

From a clinical viewpoint, air currents through the nose in humans assume great importance. Although in general inspired air is carried high up in the nose, as mentioned, air currents also traverse along the lower half of the nasal cavity. Every rhinologist has had the experience of improving the air-way temporarily, in patients with chronic nasal obstruction by the mere surface application of 5% cocaine in 1:1000 adrenaline on the inferior turbinate, provided there is no gross hypertrophy of nasal mucosa. Various other agents have also been used from time to time to shrink the mucous membrane of the inferior turbinate (Tremble 1960). In recent years, submucous electro-coagulation has been favoured. In this series, the milder form of electro-coagulation was used. This method has been found to be encouraging. About 85-88% showed improvement. Of those that showed this improvement:—

10.1% Chinese, 15.0% Indian — Showed immediate relief (Tables 3, 4 and 5)

54.0% Chinese, 47.5% Indian, 33.0% Malay — Showed temporary relief

and

62.0% Chinese, 22.5% Indian, 55.6% Malay — Showed prolonged relief

Table 2
Age Distribution According to Ethnic Group

Race	0-10 Yrs	11-20 Yrs	21-30 Yrs	31-40 Yrs	41-50 Yrs	50+	Total
Chinese	1	45	72	22	6	2	148
Indian	4	11	16	9	0	0	40
Malay	0	2	8	0	0	0	9
Others	0	1	2	0	0	0	3

Table 3
Result of Submucous Dessication in Chinese

Chinese — 148 Patients

Result of Submucous Dessication / Period of Improvement	Frequency of Submucous Dessication			Total Number Of Patients	Percentage
	Once	Twice	Thrice		
0-3 Months	8	6	1	15	10.1%
3-6 Months	41	11	2	54	36.5%
6 Months And Over	55	7	0	62	41.9%
No Improvement	13	3	1	12	11.5%

Table 4
Result of Submucous Dessication in Indians

Indians — 40 Patients

Result of Submucous Dessication / Period of Improvement	Frequency of Submucous Dessication			Total Number Of Patients	Percentage
	Once	Twice	Thrice		
0-3 Months	1	3	2	6	15.0%
3-6 Months	17	1	1	19	47.5%
6 Months And Over	8	1	0	9	22.5%
No Improvement	6	0	0	6	15.0%

Table 5
Result of Submucous Dessication in Malays

Malays — 9 Patients

Result of Submucous Dessication / Period of Improvement	Frequency of Submucous Dessication			Total Number Of Patients	Percentage
	Once	Twice	Thrice		
0-3 Months	0	0	0	0	00.0%
3-6 Months	1	2	0	3	33.3%
6 Months And Over	5	0	0	5	55.6%
No Improvement	1	0	0	1	11.1%

Table 6
Result of Submucous Dessication In Other Races

Others — 3 Patients

Result of Submucous Dessication / Period of Improvement	Frequency of Submucous Dessication: Once	Twice	Thrice	Total Number Of Patients	Percentage
0-3 Months	0	0	0	0	00.0%
3-6 Months	0	1	0	1	33.3%
6 Months And Over	0	0	0	0	00.0%
No Improvement	1	1	0	2	66.7%

On the other hand, only 10-15% of the 197 patients studied in the above ethnic groups showed no improvement at all. In this failure group, the majority had only one attempt at dessication and repeat was not considered to be beneficial as they did not have any improvement at all following the first attempt.

Histo-pathological studies as to the effect of low grade electro-coagulation is conflicting. Uede T. (1962) found that low grade high frequency electrical current apparently caused vasoconstriction, and to some extent a complete occlusion of the vascular network and fibrosis of the submucous tissue. On the other hand, due to the low grade current, no iniury was caused to the surface mucous membrane. However, H. Michishita (1965), using low grade electrocoagulation of the inferior turbinate found histologically, that the nasal mucous membrane showed a loss of cellular infiltration, degeneration of secretory glands, vascular occlusion and proliferation of fibrous tissue.

In this series, although no histological study was made, clinical observation, as evidenced by absence of dryness and crusting of inferior turbinate mucosa, or adhesion between septum and turbinates showed that there was no damage to the surface mucosa. In this procedure, the area and depth of tissue dessication with one application is directly proportional to:

(a) The current intensity
(b) Duration of current flow through the electrode
(c) The density and moisture content of the tissue
(d) The surface area of the electrode.

Factors (a), (b) and (d) were constant, the only variable being (c), that is, the individual variation of the patient's inferior turbinate mucosa.

From the ethnic point of view, the majority of patients seen at this clinic with nasal congestion and obstruction and who had this treatment were: Chinese 74%; Indians 20%; Malays 4.5% and the rest 1.5%. This, when compared with the population structure of Malaya where Malays form 50.5%, Chinese 36.4%, Indians 11% and the rest 2.1%, shows a high incidence among the Chinese, followed by the Indians. While several factors like population distribution, socio-economic conditions and other factors might account for their attendance at the clinic, nevertheless, anatomical and other elements do play a part. However, when the results of treatment of the various groups are compared, there is a striking similarity except for the "others" group. Here the number seen is too small (only 3) for any conclusion to be drawn.

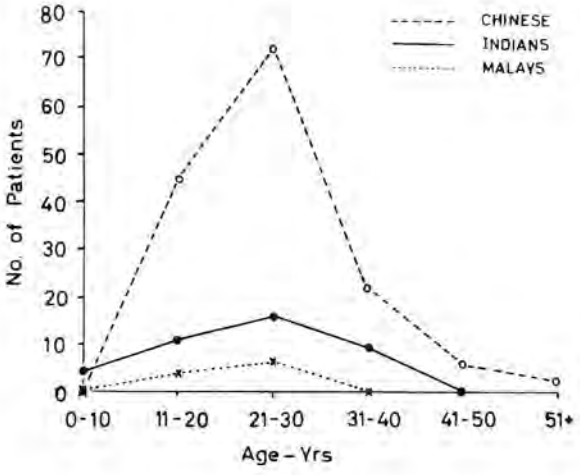

Fig. 2: Graphic representation of age distribution according to ethnic groups.

The age incidence of this condition amongst the ethnic group is interesting. There is no striking difference between the various racial groups, all showing the same age distribution pattern, the highest incidence being in the 3rd decade (Fig. 2). There is a striking absence of this condition amongst the very young and old, i.e., beyond 50 years.

Conclusion

From the data so far obtained in this series, it seems that submucous high frequency dessication does benefit those patients who otherwise go through life in great discomfort. The absence of post-dessication complication in the form of pain, crusting, adhesion, etc. is striking. The patient has no discomfort whatsoever and the whole procedure is simple and takes only a few minutes. However, the long-term effect is yet to be evaluated.

Acknowledgement

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References

1. Symposium in Electrodessication and Bi-active Coagulation — Published by The Birtcher Corporation, 1963.
2. Cuana N. 1970: Nasal Vascular Bed, — **Annals of Otology, Rhinology and Laryngology,** Vol. 79, No. 3, p. 449.
3. Cuana N. and Hinder K.H. 1969: Fine Structure of Blood Vessels of the Human Nasal Respiratory Mucosa. — **Annals of Otology, Rhinology and Laryngology,** Vol. 78, No. 4, p. 865.
4. Dewes and Pritchard 1953: Vascular Arrangement in Nasal Mucosa. — **J. Anatomy,** Vol. 87, p. 311.
5. Michishita H. 1965: A Low Grade Electrocoagulation of the Inferior Turbinates. — **Otolaryngology (Tokyo),** Vol. 37, p. 347-350.
6. Proetz A.W.: "Applied Physiology of the Nose", 2nd Edition, 1963 — Annals Publishing Co. St. Louis.
7. Ritter F. 1970: Vasculature of Nose. — **Annals of Otology, Rhinology and Laryngology,** Vol. 79, No. 3, p. 468.
8. Tremble E. 1960: Methods of Shrinking the Inferior Turbinate to Improve the Airway. — **Laryngoscope,** Vol. 70, p. 175-186.
9. Ueda T. 1962: Results of Treatment of Turbinates with weak Electrocoagulation in Chronic Rhinitis. — **Otolaryngology (Tokyo),** Vol. 34, p. 657-659.

Motor Neurone Disease

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Introduction

MOTOR NEURONE DISEASE is a chronic progressive disorder characterised by atrophy and fasciculation of the somatic musculature due to degenerative changes of motor neurone at all levels — from the motor cerebral cortex down to the anterior horn cells at the spinal cord.

The disease is subdivided into four main clinical types or groups depending upon the sites of maximal stress of the pathological processes. These are:

(1) Progressive spinal Muscular Atrophy or PMA (Aran-Duchenne's disease),
(2) Amyotrophic Lateral Sclerosis or ALS (Charcot's disease),
(3) Progressive Bulbar Paralysis or PBP (Duchenne's disease), and
(4) Infantile spinal Progressive Muscular (Werdnig-Hoffman's disease).

In this country, motor neurone disease has not been fully studied and the purpose of the present paper is to present a clinical study of 13 cases of this uncommon condition, found over a 7-year period at one medical unit in Singapore.

Materials and Methods

From January 1964 to December 1970, all patients diagnosed as Motor Neurone Disease at Medical Unit II, Outram Road General Hospital, Singapore were included in this study. The criteria for diagnosis of this disease were based on (1) a classical history and clinical picture, (2) the presence of loss of motor power, progressive atrophy of muscles and visible fasciculations at the sites of involvement, (3) compatible neurological signs, such as the presence of pyrimidal signs in ALS, (4) a rapid progressive clinical course, (5) electromyographic and muscle biopsy evidences of neurogenic muscle degeneration, and (6) exclusion of all other known causes, systemic or local. Not included were peroneal muscular atrophy (Charcot-Marie-Tooth disease), Kugelberg-Welander disease, Fazio-Londe's disease, Holmes' disease and other rare spinal muscular atrophies.

The cases are then classified into the four clinical types:— (1) Progressive Muscular Atrophy (PMA), (2) Amyotrophic Lateral Sclerosis (ALS), (3) Progressive Bulbar Paralysis (PBP) and (4) Infantile Spinal Muscular Atrophy or Werdnig-

Hoffman's disease — according to the criteria described by various other workers, (Baker, 1955; Brain, 1962, Walton, 1964).

From time to time, the patients were seen at the outpatients and reassessed neurologically. Drugs were given merely for symptomatic relief. In case of death, an autopsy was requested.

Results

The significant data of the 13 cases of Motor Neurone found during the 7-year period in one medical department were as follows: —

(A) SEX Males — 8 cases Females — 5 cases

(B) RACE Chinese — 11 cases Malay — 1 case
Indian — 1 case

(C) AGE OF ONSET AGE 0 — 9 1 case
„ 10 — 19 1 „
„ 20 — 29 2 cases
„ 30 — 39 2 „
„ 40 — 49 2 „
„ 50 — 70 5 „

(D) FAMILY HISTORY Nil.

(E) CLINICAL TYPES
(1) Progressive Muscular Atrophy 5 cases
(2) Amyotrophic Lateral Sclerosis 6 „
(3) Progressive Bulbar Atrophy 1 case
(4) Infantile spinal muscular atrophy 1 case

Fig. 1: 'Guttering' and 'clawing' of the hands from wasting of the intrinsic muscles.

Fig. 2: Marked wasting of the thenar and hypothenar muscles.

DETAILED STUDY OF EACH CLINICAL TYPE

(1) PROGRESSIVE MUSCULAR ATROPHY

(Total — 5 cases)

There were 4 males and one female in this group and their ages ranged from 20 years to 63 years with 3 cases in the sixth decade. Four were Chinese and one, an Indian. None had family history. Duration of symptoms prior to first seen was 8 months, 9 months, 12 months, 4 years and 5 years. The earliest sites of lower motor neurone involvement were the muscles of the upper limbs in 2 cases, lower limbs in another 2, and in the fifth case, the upper and lower limbs were affected simultaneously.

In the majority of cases, the disease spread from one limb girdle to another and finally involved the bulbar muscles within a few years. There was apparent clinical arrest of spread in one patient over a 2-year period. The classical sypmtoms and signs were present in all patients — viz., weakness, stiffness and clumsiness of movements of the fingers, hands, shoulders or legs, accompanied by progressive wasting and fasciculations of the affected muscles. Thus, in 4 patients, atrophy of the small muscles of the hands — the thenar and hypothenar eminences, the interossei and the lumbricals — resulted in "guttering" and "clawing" of the affected hands (Figures 1 & 2). The deltoids and other muscles of the fifth cervical nerves were next involved, producing a rounded shoulder posture and forward drooping of the head. Severe lower leg involvement in one patient resulted in bilateral footdrop and a steppage gait on walking.

Mild degrees of dysarthria, dysphonia and dysphagia were detected in three patients but none had respiratory distress. All showed tongue wasting and fasciculation of varying severity (Figure 3). In advanced cases (2), flexion contracture of limbs and 'clawing' of the toes were observed (Figure 4). Mental disturbance was not found and none had any evidence of pyrimidal tract lesions although the deep tendon reflexes were brisk in the severely wasted muscles. In two cases, the tendon jerks were abolished in the atrophied extremities. Sensory

Fig. 3: Wasting and fasciculation of the tongue.

Fig. 4: Wasting of the feet with 'clawing' of the toes.

loss was not found and most of the haematological and biochemical tests — including serum aldolase, serum creatinine phosphokinase, serum transaminases — were all within normal limits. In 3 cases, the cerebrospinal fluid protein was raised over 60 - 90 mg per 100 ml, but other components of the fluid were normal. Electromyograms in 5 cases and muscle biopsies in 3 cases revealed a neurogenic type of muscular degeneration.

Most of the patients received vitamins and anabolic agents like intramuscular Deca-Durabolin or oral Winstrol, but they showed no clinical responses. By the end of December 1970, 3 patients were still alive after having the disease for 7, 4 and 3 years. One could not be traced as he had left the country, and one succumbed to bronchopneumonia after having survived the disease for 3 years. Unfortunately, an autopsy of this patient was not obtained.

(2) Amyotrophic Lateral Sclerosis

(Total — 6 cases).

In this group of 3 males and 3 females, the ages of onset of disease were 19, 32, 44, 46, 56 and 60. All were Chinese. Duration of symptoms prior to first seen were 5 months, 7 months, 12 months, 2 years, and $2\frac{1}{2}$ years. Family history was not found. Sites of initial involvement of the disease were: upper limbs — 2 cases, lower limbs — 2 cases, and both limbs — one case. In 5 patients of this group, the lesions spread from one site to another and then became generalised after a short period of 3 months to 5 years. The condition remained fairly static, however, in one case after a 2-year follow-up. As in the previous clinical group, weakness and wasting with visible fasciculation of the affected muscles were observed in the early stages. The tongue was commonly affected and

clawing of the hands and toes were present in three advanced cases.

In addition to the above-mentioned features, signs of corticospinal and corticobulbar tracts degeneration were found — e.g. exaggerated jaw reflex, hyperactivity of the deep tendon jerks of the upper and lower limbs, clonus of patellae and the ankles, marked spasticity of the muscle tone, presence of pathological reflexes such as the Babinski responses, snout reflex, Hoffman's sign, Wartenburg's signs and so forth. Bulbar symptoms were found in 4 cases and one developed respiratory muscle paralysis. In one patient, however, the classical signs of ALS were masked by the predominance of the lower motor neurone involvement and the diagnosis was only revealed at the autopsy. Aching limbs were complained in one case but sensory changes in this patient as well as the other 5 patients were absent. Pseudobulbar lesions with impaired emotional control was encountered only in one case.

Most of the laboratory investigations were essentially normal and these included muscle enzymes, E.C.G., E.E.G. and radiological studies. E.M.G. and muscle biopsies in 4 patients showed neurogenic type of muscular atrophy. At the end of 1970, 5 out of 6 patients in this group were still alive having survived the disease for 4 years, (2 cases), 3 years (1 case) and 2 years (2 cases). The only death was the patient who developed respiratory paralysis after suffering from the disease for 2 years. In all cases, treatment was nonspecific and included drugs like vitamins, anabolic agents and so forth.

(3) PROGRESSIVE BULBAR PARALYSIS

(1 case)

In this distinct clinical entity, the muscles involved were mainly restricted to the motor nuclei of the brain stems and the course is rapidly progressive with an early fatality. One such case was found. He was a Malay man, aged 60, with progressive bulbar involvement of the tongue, orbicularis oris, palatal and pharyngeal muscles and later, the cranial nerves of the fifth, seventh and eleventh. Marked wasting and fasciculation of these muscles were seen. The patient deteriorated so rapidly within a short three-week period that he became gravely ill and was taken back home by his relatives prior to his imminent death. Other causes like basilar artery thrombosis, brain stem tumours, nasopharyngeal carcinoma, cervial myelopathy, myasthenia gravis and other diseases were excluded.

(4) INFANTILE SPINAL PROGRESSIVE MUSCULAR ATROPHY (WERDNIG-HOFFMAN'S DISEASES)

One case was found in this series. She was a 13-year-old Chinese girl with generalised weakness and marked muscle atrophy since early infancy. Proximal muscles were first affected, followed rapidly by the spread of the disease to the distal portions of the extremities as well as the trunk and tongue. Fasciculation was seen at these sites. Tendon jerks were generally absent in the wasted limbs and marked flexion contractures of the limbs were observed. E.M.G. and muscle biopsy confirmed the neurogenic origin of the muscle atrophy, but other laboratory tests yielded no significant findings. She was given symtomatic treatment, and on occasions she had a course of antibiotics for the chest infection. To date, she was alive but bedridden, totally incapacitated and requires institutional care.

Discussion

In this region, Motor Neurone Disease has not been fully investigated. Hence the present study, though small in the total number of cases, nevertheless demonstrates some interesting points in certain aspects of the disease.

Compared with most countries of the world, this disease is rather uncommon in Singapore as an average of 2 new cases was found annually. About 3.3% of neurological admissions into United States hospitals were suffering from motor neurone disorders (Friedman and Freedman, 1950; Merritt, 1963) and in most countries of the world, an incidence rate of 1.4 and prevalence rate of 4 to 6 per 100,000 population per year were estimated to have this malady (Kurland, 1957; Marburg, 1911; Dana, 1925; Wohlfahrt, 1950). Our sex ratio of 2 males to 1 female is less than that found in other series where the males were affected three or four times as frequently as females (Merritt, 1963).

Majority of patients in this series had the first signs of the disease during middle age — between ages 30 to 70, as shown in other series, but younger patients were not uncommonly seen. Eleven cases were Chinese in this study, but the other races — Malays and Indians — were not totally exempted. None had a family history, a well-known fact that inheritance seldom plays an important part in the motor neurone disorder as contrasted with the muscular dystrophies. However, there is a high familial incidence of ALS associated with Parkinsonian-dementia complex in the Chamorro people residing in the island of

Guam, and a genetic factor was implicated. (Kurland & Mulder, 1955; Hirano et al., 1961).

Of the four main types of Motor Neurone Disease, we had 5 cases of PMA, 6 cases of ALS and one case each of PBP and Werdnig-Hoffman's disease. The last two conditions were rare and the first two were more common as found in other series reported from elsewhere. The difference in clinical patterns are attributed to the variation and different combinations of the nature and distribution of the motor neurone degeneration in the spinal cord, brain stem and the cerebral cortex. A survey of autopsy materials of Motor Neurone Disease in the literature revealed higher incidence of lesions in the cervical cord and medulla than that in the lumbar cord or cerebral cortex, thus explaining the increased frequency of ALS and PMA. (Dana, 1925; Friedman and Freedman, 1950; Hassin and Dublin, 1945; Arnold et al., 1953; Wohlfart & Swamk, 1941).

On the whole, the clinical pictures of the four types in this series were not significantly dissimilar to those described in the literature. Although the classical site of initial involvement was the upper limb, a number of patients in this series however, started with the lower limbs. Duration of symptoms prior to first seen were invariably short and in most instances, the disease spread rapidly to other sites and became generalised. Typical features, like loss of muscle power, wasting and progressive atrophy, fasciculations and other neurological signs, were observed in the all four clinical types of this series. The bulbar muscles were seldom affected and mental changes as well as the sphincteric functions were rarely disturbed.

In 3 patients with PMA, cerebrospinal fluid protein was elevated over 60 mg%, a not uncommon finding in this condition. (Merritt, 1963). One patient in the ALS group showed predominantly lower motor neurone signs masking the presence of a corticospinal tract lesion. However, the diagnosis of ALS was confirmed later at the autopsy. In this study, we were not able to have pathological verification of all the cases since most of the patients were still alive. The diagnosis were made mainly on clinical, histological and electromyographic grounds.

Of the 5 cases with PMA, 3 had survived from 3 to 7 years after the illness. One died of bronchopneumonia after having been bedridden by the disease for three years and one was not traced as he had left the country. Most cases with ALS were still alive after 2 to 4 years from the onset of the disease. Majority of them were physically incapacitated. Our only case with PBP presumably died at home soon after discharge from hospital. In the literature, most cases with PMA and ALS died within 3 years after the onset. The prognosis on the whole is poor. Walton (1956) noted that the survival of patients with Werdnig-Hoffman's disease rarely exceed 12 years, but our patient with this condition had survived more than 13 years now.

Numerous theories have been postulated as to the aetiologies of Motor Neurone Disease — e.g. genetic factor, inherited predisposition, infections, syphilis, poliomyelitis, trauma, lead poison, dietary deficiency, enzyme defects, etc. — but the cause is still unknown (Schwab, 1961; Ask-Upmark, 1961; Zilkha, 1962, McMenemy 1962, Fullmer et al., 1960; Cumings, 1962; Walton, 1964). Treatment of this disease, therefore, remained nonspecific. Polyvitamins, vitamin E, vitamin B 12, prostigmine, oral and intramuscular anabolic agents have been tried as in this and other series, but the course of the disease remained unaltered.

Summary

Thirteen cases of Motor Neurone Disease, found over a 7-year period in one Singapore medical unit, were studied. The majority of the cases were Chinese males in middle age with a short history of onset of the disease. Five patients were found to have Progressive Muscular Atrophy, 6 with Amyotrophic Lateral Sclerosis, and there were one case each with Progressive Bulbar Paralysis and Infantile spinal Muscular Atrophy.

The clinical features, investigations, course and treatment of these groups were presented and discussed.

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References

Arnold, A., Edgren, D.C., and Palladino V.S.: Amyotrophic Lateral Sclerosis, **J. Nerv. & Mental Dis.** 117: 135, 1953.

Ask-Upmark, E.: Precipitating factors in the pathogenesis of amyotrophic lateral sclerosis. **Acta Med. Scand.** 170: 717, 1961.

Baker, A.B.: Clinical Neurology. Hoeber-Harper Pub. N.Y. & London. 1st Edition pg. 1743, 1955.

Brain, L.: Diseases of the Nervous System. 6th Edut. Oxford. Univ. Press. Lond. N.Y. Toronto. pg. 531, 1962.

Cumings, J.N.: Biochemical aspects of Motor Neurone Disease. **Proc. Roy. Soc. Med.** 55: 1023, 1962.

Dana, C.L.: Textbook of Nervous Diseases. N.Y. Wood. pg. 304, 1925.

Friedman A.P. and Freedman D.: Amyotropic Lateral Sclerosis. **J. Nerv. & Mental Dis.** 111: 1, 1950.

Fullmer, H.M., Siedler, H.D., Krooth, R.S., and Kurland, L.T.: A cutaneous disorder of connective tissue in amyotrophic lateral sclerosis. **Neurology** 10: 717, 1960.

Hassin, G.B. and Dublin, W.B.: Histopathology of Muscles in the spinal type of Progressive Muscular Atrophy. **J. Neuropath. & Exper. Neurol.** 4: 240, 1945.

Hirano, A., Kurland, L.T., Krooth, R.S. and Lessell, S.: Parkinson-dementia complex, an endemic disease on the island of Guam. Brain 84: 642, 1961.

Kurland, L.T.: Epidemiological investigation of amyotrophic lateral sclerosis. **Proc. Mayo Clin.** 32: 449, 1957.

Kurland, L.T. and Mulder, D.W.: Epidermiological investigations of amyotrophic Lateral sclerosis and familial aggregatations inductive of dominant inheritance. **Neurology.** 5: 182, 249, 1955.

Marburg, O.: Die amyotrophische Lateralsklerose, Handbuch der Neurologie, Berlin. Springer, 1911.

Merritt, H.H.: A textbook of Neurology. Lea & Febiger, Philadelphia. 3rd Edit. pg. 500, 1963.

McMenemy, W.H.: Pathological aspects of Motor Neurone Disease. **Proc. Roy. Soc. Med.** 55: 1021, 1962.

Schwab, R.S.: **Proc. Boston Soc. of Psych. & Neurol.** 18th May 1961.

Walton, J.N.: Amyotonia congenita. A follow up study. **Lancet,** 1: 1023, 1956.

Walton, N.J.: Disorders of Voluntary Muscle, J. & A. Churchill Ltd. Lond. 1st Edit. 417, 1964.

Wohlfart, G.: Classification — Muscular Atrophies. Staff Conf. Div. Neurol. Univ. Calif. Med Sch. May 18, 1950.

Wohlfart, G. and Swamk, R.L.: Pathology of amyotrophic lateral sclerosis. **Arch. Neurol. & Psych.** 46: 783, 1941.

Zilkha, K.J.: Contribution to discussion on Motor Neurone Disease. **Proc. Roy. Soc. Med.** 55: 1028, 1962.

Obstetric performance of the rural primigravidae 1965 to 1968, in Kuantan, Pahang.

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STUDIES ON THE OBSTETRIC performance of primigravidae in the tropics were made by Llewellyn-Jones (1965) and Thomson and Baird (1967). Llewellyn-Jones' study was on the effect of age and social status on obstetric efficiency of the primigravidae in Kuala Lumpur. Thomson and Baird's study was limited to Western Nigeria, Hongkong, Sarawak and Sabah. It is well known that efficient reproduction depends on the interaction of a number of socio-economic factors. In the author's study, the first in

Data:

The data obtained was tabulated as follows :—

TABLE I

Ethnic Group/Hospital Deliveries/Year

Ethnic Group	1965	1966	1967	1968	Total
Malays	38	46	48	66	198
Chinese	172	169	167	199	707
Indians	25	24	29	35	113
Total :	235	239	244	300	1018

Table I shows that there was an increase in the number of hospital deliveries from 235 (1965) to 300 (1968) The table also shows that there was an increase in all ethnic groups. It must be stated that many Malay primigravidae do not seek hospital confinement, but it was encouraging to note that there was a noticeable increase amongst the Malays from 1965 to 1968.

a rural area, an attempt was made to see if ethnic factors had any effect on the obstetric performance of the rural primigravidae in Kuantan, Pahang.

Method and Materials

The prospective study was carried out from January 1968 to December 1968 at the Department of Obstetrics and Gynaecology, Maternity Hospital, Kuantan. The data obtained for 1968 were then compared with a retrospective study of the records of all primigravidae delivered at the General Hospital, Kuantan from January 1965 to December 1967

TABLE II

Ethnic Group/Year/Age

Ethnic Group	Year	Age in years					
		< 14	15-19	20-24	25-29	30-34	35+
Malays	1965	0	7	23	6	1	1
	1966	0	11	23	9	3	0
	1967	2	15	20	10	1	0
	1968	0	18	33	9	6	0
Total :		2	51	99	34	11	1
Chinese	1965	0	30	85	45	7	5
	1966	0	31	82	44	11	1
	1967	0	37	66	58	6	0
	1968	0	33	93	60	11	2
Total :		0	131	326	207	35	8
Indians	1965	0	16	5	4	0	0
	1966	0	11	10	2	1	0
	1967	0	16	7	5	1	0
	1968	0	14	13	7	1	0
Total :		0	57	35	18	3	0

Table II shows that for the Malays and the Chinese, the majority were in the age group 20 to 24 years similar to the findings of Llewellyn-Jones (1965) in Kuala Lumpur but for the Indians the majority were in the 15 to 19 age group. The table also shows that there was an increase in the age of primigravidae in 1968 when compared with those in 1965. Primigravidae below the age of 15 years or above 36 years accounted for only 11 cases out of a total of 1018, an incidence of 1.8%.

TABLE III

Ethnic Group/Year/Duration of labour in hours

Ethnic Group	Year	Labour in hours					
		0-6	6-12	12-18	18-24	24-48	48+
	1965	10	16	6	3	2	1
	1966	13	19	8	4	1	1

TABLE V

Ethnic Group/Year/Weight of babies

Ethnic Group	Year	Weight in lbs.					
Indians	1965	5	13	6	1	0	0
	1966	4	10	9	1	0	0
	1967	8	5	12	4	0	0
	1968	4	11	16	3	0	0
Total :		21	39	43	9	0	0

Table V shows that for all ethnic groups, the majority of babies weighed between 6 to 7 pounds. For the Malays and Indians, the second largest group belonged to the 5 to 6 lb. groups, but for the Chinese it was in the 7 to 8 lb. group.

TABLE VI

Ethnic Group/Year/Postpartum blood loss/Retained placenta

Ethnic Group	Year	Blood loss in ozs.					Retained placenta
		0-5	6-10	11-15	16-20	20+	
Malays	1965	3	18	10	3	2	2
	1966	7	29	5	1	4	2
	1967	10	31	3	1	3	5
	1968	38	25	1	1	1	1
Total :		48	103	19	6	10	10
Chinese	1965	23	119	18	5	7	3
	1966	30	101	19	13	6	5
	1967	41	95	19	8	4	3
	1968	99	90	4	3	3	2
Total :		193	305	60	29	20	13
Indians	1965	8	15	1	0	1	0
	1966	7	10	3	3	1	1
	1967	7	16	6	0	0	0
	1968	16	14	5	0	0	0
Total :		38	55	15	3	2	1

Table VI shows that for all the ethnic groups for the years 1965 to 1967, the average post-partum blood loss was 6 to 10 ozs. For 1968, all the ethnic groups showed a reduction in post-partum blood loss to 0 to 5 ozs. There was also a lower incidence for all ethnic groups of post-partum haemorrhage and retained placenta. The explanation for this was the introduction of the author's method for the management of the third stage of labour. In this method, 1 cc of Syntometrine was given to the patient by intramuscular injection after the birth of the baby and the placenta was delivered by controlled cord traction. (Dr. Thambu 1970).

TABLE VII

Ethnic Group/Year/Foetal loss

Ethnic Group	Year	Fresh stillbirth		Macerated stillbirth		Neonatal death		
		< 5 lbs.	> 5 lbs.	< 5 lbs.	> 5 lbs.	< 5 lbs.	< 5 lbs.	
Malays	1965	0	2	0	2	1	2	7
	1966	1	1	1	1	2	1	7
	1967	0	1	1	0	0	2	4
	1968	1	0	0	1	0	0	2
Total :		2	4	2	4	3	5	
Chinese	1965	0	2	0	0	1	1	4
	1966	0	0	0	0	2	1	3
	1967	0	1	1	0	1	1	4
	1968	0	0	0	0	1	0	1
Total :		0	3	1	0	5	3	
Indians	1965	0	0	1	0	0	0	1
	1966	0	0	0	0	0	0	0
	1967	1	1	0	0	1	0	3
	1968	0	0	0	0	0	0	0
Total :		1	1	1	0	1	0	

Table VII shows a remarkable reduction in foetal loss for all ethnic groups from 1965 to 1968.

TABLE VIII

Perinatal Mortality

Year	Perinatal mortality
1965	49.7%
1966	41.7%
1967	45.1%
1968	10.0%

Table VIII shows that in 1965, the perinatal mortality was 49.7% and this was reduced over the years to 10.0% in 1968.

TABLE IX

Maternal Mortality

Year	Maternal Mortality
1965	0/1000
1966	9/1000
1967	0/1000
1968	0/1000

TABLE III

Ethnic Group/Year/Duration of labour in hours

Ethnic Group	Year	Labour in hours					
Malays	1967	14	15	6	2	3	0
	1968	24	34	6	1	1	0
Total :		61	84	26	10	7	2
Chinese	1965	54	79	23	7	8	1
	1966	45	76	34	5	7	2
	1967	44	82	24	11	6	0
	1968	72	88	31	3	5	0
Total :		215	325	112	26	26	3
Indians	1965	9	11	5	0	0	0
	1966	6	11	5	2	0	0
	1967	6	14	5	1	2	0
	1968	12	17	5	2	1	0
Total :		33	53	20	5	3	0

Table III shows that for all ethnic groups, the average duration of labour was 6 to 12 hours but for 168, there was a slight shift to 0 to 6 hours. The explanation for this was that in 1968 the author carried out clinical trials of Algapan to shorten the duration of labour (Dr. Thambu 1971).

TABLE IV

Ethnic Group/Year/Type of Delivery

Ethnic Group	Year	Type of Delivery			
		Spontaneous vaginal delivery	Assisted Breech Delivery	Forceps	L.S.C.S.
Malays	1965	24	2	8	5
	1966	31	6	6	3
	1967	30	9	2	7
	1968	45	6	5	10
Total :		30(65.9%)	23(11.6%)	21(10.6%)	25(12.6%)
	1965	140	5	19	8
	1966	143	4	16	6

TABLE IV

Ethnic Group/Year/Type of Delivery

Ethnic Group	Year	Type of Delivery			
		Spontaneous vaginal delivery	Assisted Breech Delivery	Forceps	L.S.C.S.
Chinese	1967	147	5	10	5
	1968	164	8	11	16
Total :		594(84.0%)	22(3.1%)	56(7.9%)	35(4.9%)
Indians	1965	22	1	1	1
	1966	20	2	1	1
	1967	26	1	1	1
	1968	30	2	1	2
Total :		98(86.2%)	6(5.3%)	4(3.5%)	5(4.5%)

Table IV shows that spontaneous vaginal delivery was higher amongst the Indians (86.2%) and Chinese (84.4%) than the Malays (65.9%). Table IV also shows that the incidence of forceps delivery and the Caesarean section rates were higher in the Malays (forceps 10.6% and Caesarean section 12.6%) than in the Chinese (forceps 7.9% and Caesarean section 4.9%) and Indians (forceps 3.5% and Caesarean section 4.5%). The incidence of breech deliveries was also higher in the Malays. The reason for the higher incidence of complications in labour amongst the Malays would be explained by the fact that the average Malay primigravidae does not seek hospital delivery unless her pregnancy or labour has been complicated by other factors.

TABLE V

Ethnic Group/Year/Weight of babies

Ethnic Group	Year	Weight in lbs.					
		< 5	5-6	6-7	7-8	8-9	9+
Malays	1965	5	11	13	9	0	0
	1966	7	8	18	10	2	0
	1967	5	11	17	12	3	0
	1968	8	20	26	10	2	0
Total :		25	50	74	41	7	0
Chinese	1965	8	31	76	53	4	0
	1966	10	28	75	53	3	0
	1967	5	27	75	50	9	1
	1968	8	35	78	68	8	2
Total :		31	121	304	224	24	3

Maternal mortality for 1965 to 1968 — 1.96%/1000.

Table IX shows that the maternal mortality for 1965 to 1968 was 1.96 per thousand. The maternal mortality for a similar study on primigravidae at Kuala Lumpur by Llewellyn-Jones (1965) was 0.76 per thousand.

Comments

The sociological aspects of obstetrics have been discussed in detail by Baird (1949) Llewellyn-Jones (1965) and Thompson and Baird (1967). The previous study on Malaysian women was by Llewellyn-Jones (1965) on the relationship between age, social class and the obstetric performance of the primigravidae in Kuala Lumpur.

The author's study has shown that the good obstetric performance of the rural primigravidae in Kuantan was due to the important factor that most of them were in their early twenties. It is well known that the best reproductive performance are maintained by women in their twenties. Thus the obstetric problems of the very young or the elderly primigravidae only accounted for 1.8% in this study. The author feels that with the family planning services available, a woman should be advised to plan and have her first baby in her early twenties.

The reduction in the perinatal mortality from 49.7% in 1965 to 10.0% in 1968 reflects the improvement in the ante-natal care in the rural areas. More primigravidae are seeking the services of the health clinics and the hospitals.

Thompson and Baird (1967) have pointed out that the most efficient childbearing requires youth, good health, physique and good ante-natal and hospital obstetric care. The above factors are further influenced by the interaction of social and environmental factors. The author's study on the rural primigravidae in Kuantan has shown that the obstetric performance of the Malays, Chinese and the Indians were similar and the apparent difference seen in the data obtained could be explained by the cultural and environmental factors and could not be attributed to ethnic differences.

Acknowledgement

I am grateful to the Chief Medical & Health Officer, Pahang, for permission to carry out this study. I am also grateful to the staff of the Department of Obstetrics and Gynaecology, General Hospital, Kuantan, Pahang.

References

Llewellyn-Jones J.D. (1965) *J. Obstet. Gynae. Brit C'wlth* Vol. 2 196-202.

Thompson B. and Baird D. August 1967 *J. Obstet. Gynae. Brit C'wlth* Vol. 74, 499-509.

Thambu J.A.M. (August 1970) Proceedings of the 5th Malaysia-Singapore Congress of the Academy of Medicine, Kuala Lumpur.

Thambu J.A.M. (March 1971) *Med. J. Malaya.* Vol. xxv No. 3 234-236.

Baird D. (1949) Lancet 1 1079.

Pregnancy in the achondroplastic patient: A case report

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SPAULDING (1942) once called a pregnant dwarf "an excitant of human curiosity" whereas others have considered them not only obstetric curiosities but surgical challenges. A case of pregnant achondroplasia, the most common form of disproportionate dwarfism, is described below.

Case Report

The patient was a 28-year-old Chinese, primigravida, who had been married for 1½ years. She had a normal menstrual pattern, the last normal menstrual period being on 8.4.70 - 14.4.70. Her expected date of delivery was on 15.1.71. The maturity at the first ante-natal visit (7.1.71) was 39 weeks' gestation. The patient was the eldest in a family of 5 children. Her husband, 2 brothers and 2 sisters and both parents were all normal in height and appearance.

On physical examination she presented the typical features of achondroplasia (see Figures 1 & 2). Her height was 4 feet 3½ inches (130.6 cm.)

She also had evidence of toxaemia with a blood pressure of 140/96 mm. of Hg. and oedema legs. The uterine size was about 39 weeks. The foetus was in cephalic presentation with the head unengaged. Both clinical and radiological pelvimetry revealed a grossly contracted pelvis. (see Figures 3 & 4). The typical features noted on X-ray of the pelvis were:—

(i) Deep sciatic notch
(ii) Small narrow sacrum
(iii) Reduction in height (the iliac bones appeared stubby)
(iv) Marked narrowing of the A-P diameter of inlet and outlet.

She was diagnosed as a case of pregnant achondroplasia with a severely contracted pelvis and mild pre-eclamptic toxaemia.

An elective lower segment Caesarean section was carried out on 10.1.71 and a live male baby weighing 2050 gm. was delivered. The latter showed no abnormality and was well when seen 6 months after delivery.

Discussion

Achondroplasia is a distinct entity resulting from an inborn error in the growth and development of cartilage (Maroteux and Lamy, 1964). Approximately 85-90% of all cases occur as a new dominant mutation. Only a few cases are transmitted by autosomal dominant inheritance since

Fig. 1 — Fig. 2: Photographs of patient showing features of Anchondroplasis (height = 130.6 cm).

effective reproductive efficiency is considerably reduced in this disorder (McKusick, 1966). Tyson (1970) found a high foetal wastage of 30% and explained the cause as being due to "defective germ plasm". Neonatal death rate is also high in achondroplastic infants, being due to respiratory embarrassment from thoracic cage abnormalities and neurological deficit, usually due to hydrocephalus. Morch (1941) reported 10 achondroplasics in 94,075 births (mutation rate of 1 : 24,000 gametes). Eight of these cases had normal parents.

The above patient probably represents a new mutation since the family history revealed no other members with achondroplasia. Parental age did not appear to play a role since both parents were quite young at the time of her birth.

She was married to a normal spouse and as shown in the diagrammatic representation of an autosomal dominant factor, she has a 50% chance of giving birth to an achondroplasic child (Figure 5). The obstetrician is here obliged to make the patient aware of this fact, and help her to arrive at a mutually satisfactory decision as regards further pregnancies. This patient has followed our advice and is now on the contraceptive pill.

Tyson et al (1970) are of the opinion that the single most important objective in ante-natal care is the recognition of impaired cardio-respiratory function. In his series, 2 achondroplasts recalled living propped up in rocking chairs for the last 50 days of gestation because of respiratory embarrassment. This is associated with limited abdominal size. They, therefore, advised early delivery (35-37 weeks). This patient did not present this feature.

Although in Tyson's series of 25 cases there was no evidence of pre-eclamptic toxaemia, Gardiner (1970) has postulated its development in this sort of patients as due to possible pressure on inferior vena cava or renal vessels as a result of prolonged and excessive intra-abdominal distension.

The case under review is the second case of pregnant achondroplasia which the writer has managed. Both had mild pre-eclamptic toxaemia.

The mode of delivery in an achondroplasic

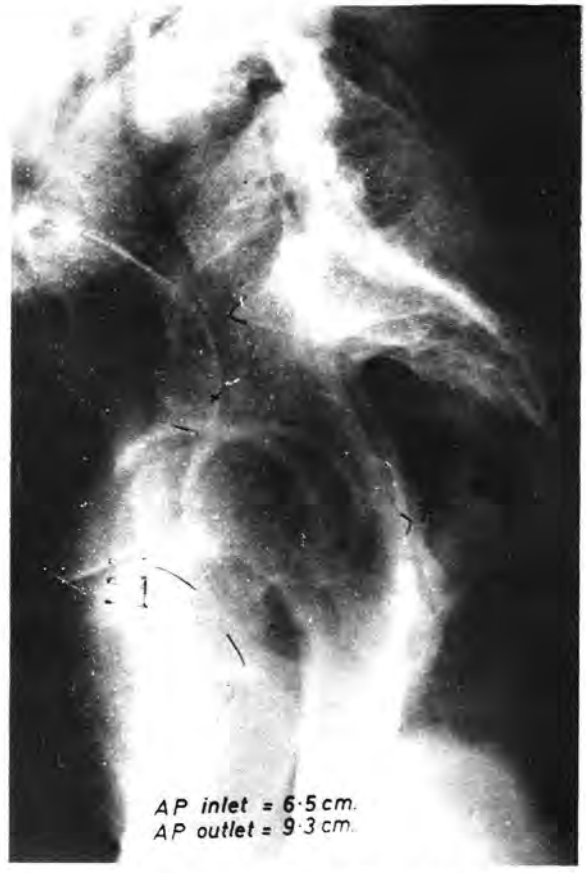

Fig. 3 — Fig. 4: X-ray pelvimetry showing gross pelvic contraction (AP and lateral views).

mother is invariably by lower segment Caesarean section because there is every likelihood of major cephalo-pelvic disproportion from severely contracted pelvis.

Summary

A case of achondroplasia in pregnancy is described. The mode of inheritance of this disease entity, the complications in pregnancy and the method of delivery are discussed.

Acknowledgement

I wish to thank Professor T. A. Sinnathuray for permission to publish this case and helpful criticism in the preparation of this paper.

References

Maroteux, P. and Lamy, M. (1964): Achondroplasia in man and animals; Clinical Orthopedics and Related Research, 33: 91-103.

McKusick, V.A. (1966a): Heritable Disorders of Connective Tissue, 3rd Ed. p. 441, C.V. Mosby, St. Louis (1966b): Mendelian Inheritance in Man, Catalog. of Autosomal dominant, p. 3, John. Hopkin Press, Baltimore.

Morch (1941): E.T. Chondrodystrophic dwarfs in Denmark as quoted in Clinical Orthopedics and Related Research by Maroteux, P. and Lamy, M. (1964).

Gardiner, S.H. (1970): **Amer. J. Obstet. Gynae.** 108: 704.

Spaulding, H.C. (1942): **Amer. J. Obstet. Gynae.** 43: 720.

Tyson, J.E. et al (1970): Obstet. and Gynaec. Considerations of dwarfism, **Amer. J. Obstet. Gynae.** 108: 688.

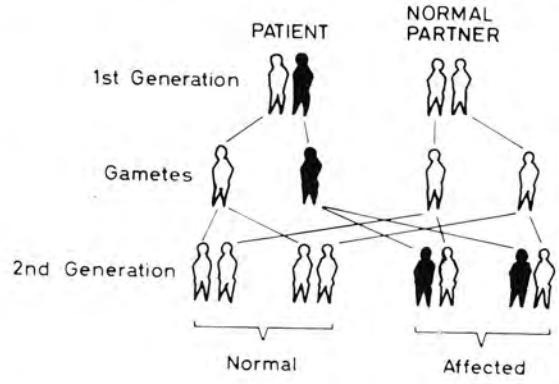

Figure 5 TRANSMISSION OF DISEASE INHERITED AS AN AUTOSOMAL DOMINANT FACTOR

Infectious mononucleosis in Singapore: A report of two cases

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INFECTIOUS MONONUCLEOSIS is an acute infectious disease characterised by fever, enlargement of the lymphatic glands, and changes in the blood, especially lymphocytosis and the presence of heterophil antibodies, and with a uniformly favourable course (Tidy, 1956). It is said to occur more frequently in temperate countries and is commonest in children and young adults. The causal agent has not been identified, but it is presumed to be a virus.

Only one proven case of infectious mononucleosis has been reported in this country; this was in an American (Sreenivasan, 1966). Time and again, clinicians have diagnosed infectious mononucleosis on clinical and haematological features characteristic of the disease but have been disappointed because the Paul-Bunnell tests were negative. In Malaya, over a period of 12 years (1954-1965), 401 Asians with clinical features suggesting infectious mononucleosis were investigated and not one had a positive Paul-Bunnell test (Tan, 1967).

In this paper, we report two cases of infectious mononucleosis; one in a Chinese boy and the other in an Englishman.

Report of Cases

Case 1

This patient, a 12-year-old Chinese schoolboy,

was admitted for fever with chills of 10 days' duration. He also had a watery diarrhoea during the first three days of his illness. He was born in Singapore and had never been out of the country. On clinical examination, he was febrile (102°F) and had an inflamed pharynx. His cervical, suboccipital, axillary and inguinal lymph nodes were enlarged. His liver was two fingers-breadth and his spleen one finger-breadth palpable below the costal margin. His mesenteric lymph nodes were palpable per abdomen. His tendon reflexes were normal and his toe jerks present.

Laboratory investigations revealed a total white cell count of 12,400 per cu. mm. (65% polymorphs; 29% lymphocytes; 4% monocytes and atypical mononuclear cells 2%). Widal and Weil-Felix agglutination tests were negative and stool cultures grew no pathogenic organisms. The Mono test was also negative. Because the clinical features and blood picture strongly suggested infectious mononucleosis, the "Denco-IM" test was performed and it was positive.

The fever subsided in a few days without antibiotic therapy and he was discharged well after nine days' stay in hospital.

Case 2

This patient, a 24-year-old Englishman, had a history of left hypochondrial ache followed a week later by four days of fever. He then felt lethargic and malaised. On clinical examination, he was not pale nor jaundiced. His cervical and inguinal lymph nodes were enlarged. There was no sternal tenderness. His liver was two fingers-breadth and his spleen four fingers-breadth palpable below the costal margin. Clinically, he was thought to be suffering from infectious mononucleosis.

Laboratory investigations revealed a leucocytosis of 14,500 per cu. mm. (14% polymorphs; 60% lymphocytes; 8% monocytes and 15% atypical mononuclear cells). The Mono test was negative. As in Case 1, the "Denco-IM" test was positive.

Discussion

Infectious mononucleosis is noted for the variable ways in which it may present. Often, the symptoms are no more than those of an upper respiratory tract infection, but it may present as lymphadenopathy, a pyrexia of unknown origin, with rash, lassitude, jaundice, hepatomegaly, splenomegaly, or with central nervous system manifestations (Tidy, 1956). The blood changes usually consist of a leucocytosis, commonly between 10,000 to 15,000 per cu. mm., but higher counts may occur. Initially, there may be a relative granulocytosis, but this is followed by the characteristic increase of non-granular cells (amounting to 60 to 80% of the total white cell count). These include normal lymphocytes, normal monocytes and atypical mononuclear cells (Tidy, 1956).

The only way of proving the diagnosis of infectious mononucleosis is by demonstrating the presence of heterophil antibodies by the Paul-Bunnell test; a titre of 1 : 56 or more being usually taken as diagnostic. In order to make the test specific, it is usual to repeat it, when it is positive, according to Davidsohn's (1937) modification, using guinea-pig kidney suspension and serum treated with ox red blood cells, but this complete Paul-Bunnell test is cumbersome, time-consuming and expensive. Hence arose the use of slide agglutination techniques.

The Mono test, which uses sheep red blood cells, was employed to confirm the diagnosis of infectious mononucleosis in the above two patients, but the results were negative. Because of the strong clinical conviction that these two patients had infectious mononucleosis, a new test, the "Denco-IM" test, produced by Denver Laboratories, Ltd., London, was used, and it was positive in both patients. This test uses a 4% suspension of formalized horse red blood cells. Three trials of this test were carried out (Sheil, 1967; Dann, 1967; Davidson, 1967) in addition to the one by Hoff and Bauer (1965), who first described it. These trials showed an overall accuracy of 90% compared with the Paul-Bunnell test with a titre of at least 1 : 56.

In the above two patients, the positive "Denco-IM" tests over the negative Mono tests serve to illustrate the superiority of the "Denco-IM" test over the Mono test. With greater use of the "Denco-IM" test, infectious mononucleosis may be more commonly detected in Singapore than at present.

Summary

Infectious mononucleosis is considered to be a rare disease in Singapore. In this paper, we report two cases of infectious mononucleosis, one in a Chinese boy and the other in an Englishman. Both were clinically characteristic. The Mono tests were negative, but in both patients, infectious mononucleosis was confirmed by a new and more accurate test, the "Denco-IM" test.

Acknowledgements

We wish to thank Dr. K. K. Tan of the Medical Laboratory, Singapore, for performing the "Denco-IM" test for us.

References

1. Bauer, S. and Hoff, G. (1965): "A new rapid slide test for infectious mononucleosis". **J. Amer. med. Ass.,** 194, 351.
2. Dann, T.C. (1967): "A new test for the detection of infectious mononucleosis". **Brit. J. Clin. Pract.,** 21, 511.
3. Davidsohn, I. (1937): "Serolongic diagnosis of infectious mononucleosis". **J. Amer. med. Asso.,** 108, 289.
4. Davidson, R.J.L. (1967): "New slide test for infectious mononucleosis". **J. Clin. Path.,** 20, 643.
5. Sheil, L.P. (1967): "The 'Denco-IM' test in the diagnosis of infectious mononucleosis". **Practitioner,** 199, 200.
6. Sreenivasan, B.S. (1966): "A case of infectious mononucleosis in Singapore". **Singapore Med. J.,** 7, 69.
7. Tan, D.S.K. (1967): "'Absence' of infectious mononucleosis among Asians in Malaya". **Med. J. Malaya,** 21, 358.
8. Tidy, H.L. (1956): "Refresher course for general practitioners". **Brit. Med. Association,** London.

A simple instrument for ascending urethrography in males

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Introduction

THE URETHRA IN the male can be examined either by a micturating cysto-urethrogram or an ascending urethrogram.

A micturating cysto-urethrogram can only be done when the patient is able to micturate adequately during the examination. This method often fails in cases of impassable stricture of the urethra.

An ascending urethrogram is a retrograde examination and can be done by two known methods:—

(1) By the use of a Foley Catheter
The disadvantages of this method are:

(a) Trauma to urethra.

(b) Inability to examine the anterior urethra.

(c) Slipping of the catheter out of the urethra during examination, especially in cases of impassable urethral stricture.

and (2) By the use of a Knutsson cannula and clamp
The disadvantages of this method are:—

(a) This instrument is not easy to use except in skilled hands.

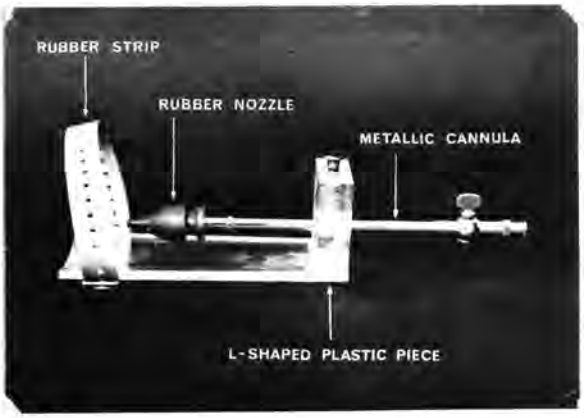
(b) It can be traumatic to the urethra when not properly applied to the penis.

(c) The instrument itself often obscures fully or partially the visualisation of the anterior urethra during the examination.

Because of the disadvantages encountered in the above methods, we have devised a simple instrument which has been used for the last six months in the X-ray Department, University Hospital, Kuala Lumpur.

Description of the instrument

It comprises a plastic piece, a hollow metal cannula, a rubber nozzle and a rubber/plastic strap. The plastic piece is shaped like a letter "L". The horizontal part is longer than the vertical part. The horizontal part is that part of the instrument against which the penis is strapped firmly by the plastic/rubber strap. The vertical part has a hole in its centre through which passes the hollow metal



cannula. At one end of the metal cannula is fixed the rubber nozzle which is applied to the urethral meatus and to the other end is attached a syringe with contrast media.

Technique

Strict asepsis is essential. The patient is asked to empty his bladder before the start of examination. A plain film of the pelvis is done. This may show the presence of:—

(a) Prostatic calculi.
(b) Calcification in the bladder wall as seen in TB cystitis and schistosomiasis.
(c) Urethral calculus.
(d) Sometimes even radio-opaque foreign bodies.

The patient is examined in the supine position on the X-ray table. The cannula is properly applied to the penis meatus and the instrument is strapped firmly on to the penis by a rubber or plastic strap. The penis is discreetly stretched and kept steady. Injection of about 20 cc of Conray 280 is done under fluoroscopic control. Spot films are then taken with the patient in the antero-posterior, right oblique and left oblique positions. Sometimes spot films are taken with the patient in the true lateral position, either right or left. During the injection, the patient is told to attempt to micturate and hold his breath. This manoeuvre reduces the tonus of the anatomical unit formed by external sphincter, prostatic urethra and bladder neck, thus facilitating the inflow of contrast medium. Otherwise the contrast may be arrested at the level of the external sphincter even in the absence of true spasm of the latter. Air bubbles can sometimes be present in the urethra and may prejudice the diagnosis. It is important therefore to exclude air from the instrument. This can be easily done by flushing the cannula of the instrument with saline, thereafter filling it with saline solution before applying it to the penis.

Complications

(1) Extravasation of contrast into cavernous tissue (urethro-cavernous reflux) and blood vessels (intravasation). Hence water soluble contrast is used to avoid the danger of pulmonary embolisation.

(2) The danger of irradiation to the testes must be evaluated against the advantage of information obtainable. Lindbolm and Romanus (1962) state that in the average examination, the dose to the gonads amount to 0.5 r per exposure.

Conclusion

In our six months of experience with the use of this new instrument in ascending urethrography, we, in the X-ray Department, University Hospital, found the following advantages, viz.

(1) The entire urethra is visualised.

(2) It is less likely to traumatise the urethra, and

(3) It can be used with ease even by a trainee radiologist.

Acknowledgement

I wish to record my thanks to Mrs. Pearly Thoo for typing the manuscript and Mr. Muthu of Medical Illustrations for the labelled diagram.

References

(1) Lindbolm K and Romanus R (1962): The encyclopedia of Urology. Volume 5/1. Diagnostic Radiology. ed., Atken C.E. Dix V., Weyrauch H.M. and Weldbolz (Berlin: Springerverlag).
(2) "Medical Radiology" by David Sutton.
(3) J.A. Veiga Pires, E.A. Flebate. Volumn 39, 1967, British Journal of Urology.

Book Reviews

PARASITES OF MAN IN NIUGINI by W.H. Ewers and W.T. Jeffrey. The Jacaranda Press. Queensland. pp. 275. A$6.95.

THE BOOK IS addressed to Niuginians (the people of the Territory of Papua and New Guinea) and is written in a language which can be easily understood by them. In many villages throughout Niugini, people still believe in witchcraft and sorcery and most of their lives have been dominated by fear. It is dispel the idea of witchcraft as the source and cure of parasitic diseases that the book is directed to high school and university students, and officers of the malaria service and other departments. The book attempts to present a scientific understanding of the causes of many of the parasitic diseases that afflict man and how they can be conquered by interfering with their life cycles.

The parasitic diseases of Niugini are the same as those of many tropical countries of Asia and a large part of the book is devoted to malaria, filariasis and alimentary parasites with much local information. The illustrations are clear and lucid, and the book contains a bibliography of work concerned with the parasites of man in Niugini and West Irian.

RESEARCH IN DISEASES OF THE TROPICS Edited by E.C. Gordon Smith. British Medical Bulletin Vol. 28. No. 1, 1972 £2.50.

IN THIS ISSUE of the British Medical Bulletin, Dr. Gordon Smith, as Scientific Editor, has assembled a team of 20 outstanding British workers to review progress in tropical medical research. It emphasises how recent advances in techniques are being successfully applied to many hitherto insoluble problems and how advances in knowledge are coming from research institutes and laboratories all over the world. Among the topics dealt with are arbovirus diseases, leprosy, malaria, trypanosomiasis, leishmaniasis, schistosomiasis, filariasis, onchocerciasis, heart disease in the tropics, tropical sprue and anaemias in the tropics. Dr. Gordon Smith himself contributes a useful paper on the changing patterms of disease in the tropics and reviews the factors which have brought about these changes.

This symposium should be in the hands of all serious research workers in tropical diseases and in all medical libraries.

TEXTBOOK OF ORTHOPAEDIC MEDICINE, Vol. 2 TREATMENT BY MANIPULATION, MASSAGE AND INJECTION. by James Cyriax. 8th Edn. 1971 Bailliere Tindall. Lond. pp. 432.. 149 plates. £4.

THIS IS THE supplement to Vol. 1 which deals with the diagnosis of soft tissue lesions; together, they constitute a valuable reference work for all medical pracitioners and physiotherapists. This volume first appeared 27 years ago and the present edition incorporates the many advances that have been made in orthopaedic medicine since.

The auther points out that thanks to improved diagnosis, treatment can now be directed to the lesion alone, referred pain and tenderness being ignored. Physiotherapists will find in this volume all the information they require to carry out successful treatment of a wide variety of common lesions, including athletic injury and overstrain of muscles, tendons and ligaments. Each manoeuvre is so profusely illustrated and so well

described that even the uninitiated cannot go wrong if the instructions are followed in every detail. This book will be of immense value to all those who carry out manipulation, massage, traction, injections and deep friction in the diagnosis and treatment of disorders of the soft tissues.

PREVENTIVE MEDICINE IN MEDICAL CARE by Kurt Schwarz. Lewis & Co. Lond. 1970 pp. 216 £2.50.

THIS BOOK IS intended as a practical guide to the practice of preventive medicine and the application of preventive medical procedures to individuals and to the community. It deals with infectious diseases, diseases spread mainly via the gastro-intestinal tract, disease spread mainly by contact, zoonoses, and non-infectious diseases. The usual arrangement of each chapter is: (a) clinical features, (b) atypical features (c) presymptomatic diagnosis, (d) epidemiology, (e) at risk groups (f) preventions and (g) public health aspects.

Dr. Schwarz's handy volume has a wide appeal; not only doctors in public health, community medicine and administrative medicine will benefit from a study of it but also doctors in general and hospital practice and students, both undergraduate and post-graduate. There is an index.

Notices

BOARD ON POSTGRADUATE MEDICAL EDUCATION FACULTY OF MEDICINE UNIVERSITY OF MALAYA

Part I of the Fellowship Examination for the F.R.C.S., Edinburgh

The above examination will be held in the University of Malaya Medical Centre from 31st October to 2nd November, 1972. It will consist of a multiple choice paper composed of the subjects of Anatomy, Physiology and Pathology including Bacteriology and an oral examination in each of these subjects. A general knowledge of the basic principles of Anatomy, Physiology, Pathology and Bacteriology as applied in the field of Surgery will be the scope of the Examination.

Application forms are available from the Administrative Assistant, Board on Postgraduate Medical Education, Faculty of Medicine, University of Malaya. The completed forms should be returned to the Administrative Assistant together with a cheque for the examination fee ($558/-) payable to the Royal College of Surgeons of Edinburgh. The closing date for entry to the examination is Saturday, 16th September, 1972.

Basic Medical Sciences Course

A full-time course in the Basic Medical Sciences designed to prepare medical graduates for the above Examination will be held from 1st August to 30th October, 1972 in the University of Malaya Medical Centre. Admission to the course will be restricted to those who intend to sit for the Examination. The course fee is $300.00. Application to enrol for the course should be accompanied by a cheque payable to the Board on Postgraduate Medical Education, University of Malaya, not later than July 1st, 1972.

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