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Seoul, Korea.

## TREATMENT FOR POTT'S PARAPLEGIA

By

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### INTRODUCTION

Tuberculosis of the spine is today an uncommon disease in Western countries. In many other countries, however, it still has such a high incidence that it represents a constant and important challenge to the orthopaedic profession. The antituberculosis drugs have improved the prognosis made possible more effective treatment but have still not solved all the problems.

Literature on the treatment of tuberculosis of the spine is voluminous. Only a few authors, however, have dedicated their papers to paraplegia as their main subject. The present author feels that paraplegia constitutes such an important problem that it deserves special and separate interest.

For that reason it was felt that a review of cases of Pott's paraplegia treated in the Orthopaedic Department of the National Medical Center in Seoul, Korea, in the years 1959 to 1963 might be of some interest. The treatment represented two varying surgical methods—radical evacuation of tuberculous tissue with and without simultaneous anterior spinal fusion. This makes it possible to compare the results and evaluate the advantages of these two methods of treatment.

### REVIEW OF LITERATURE

In this review only publications are surveyed in which the treatment of paraplegia is discussed.

*Orthodox treatment* (constitutional therapy with recumbency, immobilisation with or without additional antituberculosis drugs).

The results are not encouraging. A reasonable degree of recovery in 54 out of 67 with incomplete paraplegia was reported by *Seddon* (1935)

and complete recovery in 10 out of 23 *Alvik* (1949). "Dobson reported on 136 cases in whom one in every four died and less than half made a worth-while recovery" (*Griffiths, Seddon & Roaf* 1956). Orthodox treatment with the addition of antituberculosis drugs in children was reported by *Kaplan* (1959) as 83 per cent recovery as compared to 58 per cent recovery without drugs.

#### *Antero-Lateral Decompression*

*Griffiths, Seddon & Roaf* (1956) reported in their above-mentioned monograph on Pott's paraplegia the results of antero-lateral decompression with 36 recoveries out of 50 paraplegic patients.

#### *Radical Evacuation of Tuberculous Tissue*

Radical operation before the introduction of antituberculosis drugs was no success. Some patients recovered, but opening a tuberculous abscess had frequent and serious complications which presented a greater threat to the life of the patients than the paraplegia. Following the introduction of the antituberculosis drugs *Wilkinson* (1949), *Hald* (1950), *Orell* (1951), *Kastert* (1951), *Kondo & Yamada* (1951) started to do a "radical operation" for tuberculosis of the spine. Among their cases were cases with paraplegia. *Bosworth* (1953) and *Felländer* (1954) respectively reported four improved out of five patients treated. *Paus* (1964) reported the use of this method omitting enforcement of recumbency and immobilisation and had 10 complete recoveries in 21 patients.

#### *Radical Evacuation of Tuberculous Tissue with Anterior Spinal Fusion*

*Hodgson & Stock* (1956) approached the spine anteriorly. After removal of all tuberculous tissue including the surroundings as far back as the spinal cord they inserted strut grafts to keep the vertebral bodies sprung apart. Among their first 100 cases they had 35 paraplegic patients with 26 complete recoveries. Seventy-five of their patients were children.

### PRESENT STUDY

#### *Material*

The material comprises 63 consecutive cases of Pott's paraplegia operated at the Orthopaedic Department of the National Medical Center,

Seoul, Korea, during the years 1959-1963. In this period, 315 patients with tuberculosis of the spine were treated at the department. The incidence of paraplegia in this series is 20.0 per cent. This incidence may be slightly higher than it would have been in a completely unselected group of patients, as some paraplegic patients were given priority for admission to the ward.

The material was divided into two groups. Group I includes 33 patients operated by radical evacuation of tuberculous tissue, group II includes 32 patients operated by simultaneous anterior spinal fusion. Two adults are included in both groups as they first underwent radical operation and later were reoperated by anterior spinal fusion because of unfavourable results.

### *Survey of Patients*

*Age distribution* is given in Table 1. Children and adults in the two groups were nearly identical.

*Sex distribution.* There were 31 males and 32 females, evenly divided in group I and II.

*Region of spine involved* is given in Table 2. Only six cases involved the cervical or cervico-dorsal spine, 50 the dorsal and 9 the dorso-lumbar spine.

*Number of vertebra affected* averaged 3.2 in group I among the children and 3.4 among the adults, while it averaged 3.5 in group II among the children and 2.5 among the adults.

*Sinus formation* was rarely seen in combination with paraplegia.

*Pulmonary and other tuberculous manifestations.* Pulmonary tuberculosis occurred in eight of the 33 patients in group I and in 16 of the

*Table 1. Age distribution.*

Age	Number of patients		Total
	Group I	Group II	
0-4	7	7	14
5-14	9	7	16
15-24	3	2	5
25-44	13	10	23*
45-59	1	5	6
60 and above		1	1
	33	32	65*

\* Two adults were included in both groups. (This goes for all tables).

32 patients in group II. Other complications occurred in three in group I and three in group II.

*Observation time* is shown in Table 3.

*Summary.* The average distribution, sex, region of the spine involved, number of vertebra affected and pulmonary and other tuberculous manifestations did not differ much in the two groups. The average observation time is somewhat longer in group I than in group II.

Table 2. *Region of spine involved.*

Region	Group I	Group II	Total
Cervical	1	2	3
Cervico-dorsal	2	1	3
Dorsal	26	24	50
Dorso-lumbar	4	5	9
	33	32	65

Table 3. *Observation time.*

Months	Group I	Group II
3-12	6	5
13-24	7	21
25-36	16	6
37-47	4	-

### *Survey of Paraplegia*

*Type (onset) of paraplegia.* Table 4 shows there were 54 cases of paraplegia where the paraplegia developed within two years after the first spinal symptom appeared, and 11 cases were late paraplegia. In children 27 were early and three late, in adults 27 were early and eight late.

Table 4. *Type (early or late) of paraplegia.*

	Group I	Group II	Total
Early paraplegia	27	27	54
Late paraplegia	6	5	11
	33	32	65

*Grade of paraplegia* is shown in Table 5. In 50 cases the paraplegia was complete, in 15 cases it was incomplete. 29 in group I had spastic paraplegia, four had flaccid paraplegia. In group II all had spastic paraplegia including one child who had quadriplegia.

*Duration of spinal symptoms* before operation is given in Table 6.

*Duration of paraplegia* before operation is shown in Table 7.

*Table 5. Grade of paraplegia.*

	Group I	Group II	Total
Complete paraplegia	27	23	50
Incomplete paraplegia	6	9	15
	33	32	65

*Table 6. Duration of spinal symptoms before operation.*

Years	Children	Adults	Total
Less than 2	23	22	45
2-10	8	12	20
	31	34	65

*Table 7. Duration of paraplegia.*

Months	Group I	Group II	Total
1- 6	15	12	27
7-12	8	8	16
13-24	8	7	15
25-48	1	4	5
49 and more	1	1	2
	33	32	65

*The proportion of complete versus incomplete paraplegia in the early and late type of cases* is shown in Table 8. The proportion of complete paraplegia was the same in children and adults, i.e. 21 children out of 29 and 29 adults out of 36. The proportion was the same also in early and late paraplegia, i.e. 42 in early cases out of 54 and eight late cases out of 11.

The proportion of complete versus incomplete paraplegia in relation to the duration of the spinal symptoms is shown in Table 9. Complete paraplegia was more common in cases with a spinal history shorter than two years, 24 out of 45, than in cases with a longer history, seven out of 20. The figures are too small, however, to draw any conclusion.

Finally, the relationship between the grade of paraplegia and its duration before treatment is shown in Table 10.

Table 8. The proportion of complete versus incomplete paraplegia in early and late paraplegia.

	Complete paraplegia		Incomplete paraplegia		Total
	Children	Adults	Children	Adults	
Early paraplegia	18	24	6	6	54
Late paraplegia	3	5	2	1	11
	21	29	8	7	65

Table 9. The proportion of complete versus incomplete paraplegia in relation to the spinal symptoms.

Years	Complete paraplegia	Incomplete paraplegia	Total
Less than 2	24	21	45
2-10	7	13	20
	31	34	65

Table 10. Grade of paraplegia in relation to its duration before treatment.

Months	Complete paraplegia	Incomplete paraplegia	Total
Less than 6	25	2	27
6-12	12	3	15
13-24	11	4	15
25 and above	2	6	8
	50	15	65

### Treatment

Antituberculosis drug treatment before the patient came to our Out-Patient-Department. In group I only four patients had regular medica-

tion for some period of time and in group II one third had relatively regular medication before being seen by us. PAS and INH were given to the patients from their first visit to the Out-Patient-Department of the hospital. During their hospital stay, streptomycin was given in addition. The period of medication (PAS-INH) before operation varied between two weeks and 12 months, depending on available beds in the ward and thus was left to chance. The medication period with SM varied between 10 days and two months. After discharge from the hospital, medication with PAS and INH were continued for one year or more after operation.

*Hospitalisation* lasted from three to seven days before operation for additional examination and pre-operative care. Hospitalisation following operation lasted eight days to two months. In group I, it averaged 29 days and in group II 34 days. Of eight patients with more than 60 days, five had pulmonary or urinary tuberculosis which needed further hospitalisation and three had complications of short duration.

No enforced recumbency or immobilisation was given in group I. In group II recumbency in a plaster-bed was used for an average of three months in order to facilitate consolidation of the grafts, thereafter replaced by a corset the application period of which varied between three and 12 months, depending upon the extent of the lesions.

*Operation.* Surgery in group I consisted of the evacuation of tuberculous tissue through an antero-lateral incision in cervical cases and through a costo-transversectomy in the other cases. Surgery in group II was done through an antero-lateral incision in cervical cases and through a thoracotomy in dorsal cases and thoraco-abdominal incision was used in lower dorsal and dorso-lumbar cases. In group I, 27 patients were operated on once while six had two operations and in group II, 29 patients were operated once and three were operated twice.

#### OPERATIVE FINDINGS

##### *Group I*

In group I, gross pathology was found in 31 cases, inflammatory products were found in 31 cases, sequestered material in 30. Small amounts of bone sands were found in three cases. Thirty-three showed paravertebral soft tissue shadow on radiography, an abscess was found in 19, granulation tissue in nine and caseous material in five cases. No abscess material was found in three cases.

In most cases it was not possible to inspect the cause of paraplegia

because of the limited approach, but compression by sequestra was seen in two.

By microbiological and histological examination, acid fast bacilli and tuberculous granulation tissue were found in 20 cases, tuberculous granulation tissue was found in 10. In three cases neither acid fast bacilli nor tuberculous granulation tissue were demonstrated.

### Group II

In group II the compressing agent was found in all cases. The data are given in Table 11.

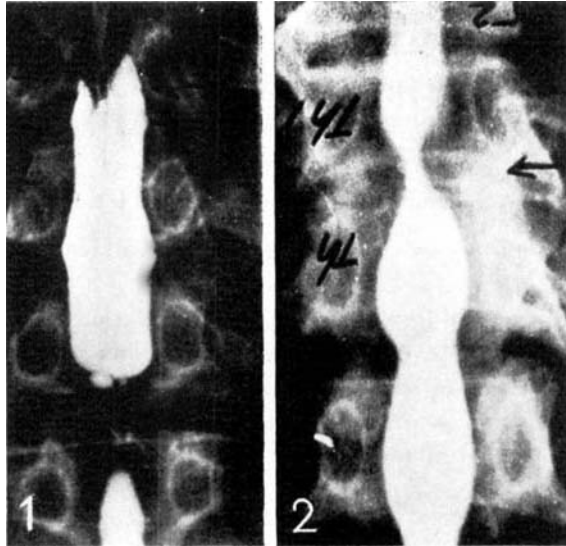
Operative findings in relation to the type (early or late) of paraplegia are given in Table 12.

*Table 11. The cause of the compression found in 32 cases operated by anterior spinal fusion.*

Inflammatory product	Abscess		4	} 9
	Granulation tissue		2	
	Abscess and granulation tissue		1	
	Caseous material		2	
Sequestered material	Bone	plus inflammatory product	7	} 14
	Disc		4	
	Bone and disc		3	
	Sequestered bone and disc	plus fibrous adhesion	2	} 2
Solid material	Bony ridge	plus intra-spinal fibrosis	3	} 7
	Fibrosed mass of disc		1	
	Bony wall (vertebra)		1	
	Bony ridge and fibrosed disc		2	

*Table 12. Cause of compression in relation to the type of paraplegia found in anterior spinal fusion.*

	Early paraplegia	Late paraplegia	Total
Inflammatory product	8	1	9
Inflammatory product and sequestered material	15	1	16
Solid material	3	4	7
	26	6	32



Acid-fast bacilli only were found in six cases, acid-fast bacilli and tuberculous granulation tissue in five, and tuberculous granulation tissue in 21 cases.

#### COMMENTS ON THE OPERATIVE FINDINGS IN GROUP II

##### a) *The Compression Agent*

*Griffiths, Seddon & Roaf* (1956) commented on this particular problem and described this form "caused by inflexion of the spine, bony ridge in the floor of the spinal canal" which is the commonest cause of late onset of paraplegia. *Hodgson* (1960) reported on a similar case. The present author observed seven cases of this particular cause of paraplegia.

##### b) *The Relationship to the X-Ray Findings*

Plain X-ray and tomogram gave little information as to the cause of paraplegia, even in cases where bony spurs were found to be the cause of compression at operation.

Myelography on the other hand gave valuable information. In one case a sharp indentation, in another a complete block was demonstrated (Figure 1). In one case with concentric compression and strangulation of the dura, myelography showed an "hour-glass" formed

shadow (Figure 2). Three cases in the healing stage of paraplegia showed a complete block with small ears of contrast-medium pointing to the periphery of the spinal canal. Complete block seems to correspond to an extradural space filled up with fibrosis and adhesions.

#### RESULTS OF OPERATION

The results of operation in group I and II are respectively given in Tables 13 and 14.

As to the three children who had no recovery in group I, all had extensive lesions and in one case the failure was proved to be due to collapse of the cord following operation, which was observed at the second intervention. In another the failure may be due to a similar cause. The third died of pneumonia after three months.

*Table 13. Results of operation in Group I.*

Results	Children	Adults	Total
Complete recovery	13	10	23
Incomplete recovery	—	4*	4*
Failure	3	3	6
	16	17*	33*

\* One adult who recovered completely from completely paraplegia after radical operation, however, later developed recurrence of paraplegia is included.

*Table 14. Results of operation in Group II.*

Results	Children	Adults	Total
Complete recovery	14	14*	28*
Incomplete recovery	—	4	4
	14	18*	32*

#### COMPLICATIONS

In group I serious complications consisted of damage to the cord in two cases during surgery with subsequent complete paraplegia, and the two earlier mentioned cases of excessive collapse during operation. In one case a sinus formation in the wound healed after one month.

In group II, there were no serious complications. One thoracic duct was damaged when the intercostal arteries were divided close to the aorta. Immediate ligation was successful. In one case the lower end of the graft was found to be displaced two months after operation. Re-operation gave subsequent healing. Fracture of the graft was found in the post-operative period in 11 cases where more than four vertebrae were affected and totally removed. They all healed subsequently.

There were no fatalities in either group in the immediate post-operative periods. In group I, one child and one adult died from pneumonia, three to 12 months after operation and a third died after six months cause unknown.

In group II, there were no fatalities in the follow-up period.

### *Factors Influencing the Results of Treatment*

*Age.* In this series the age of the patients seems to affect the results of treatment in the quality of the recovery and in the rapidity in regaining walking capacity after operation.

In group I, complete recovery occurred in children in 13 out of 16, 81.2 per cent, in adults in 10 out of 17, 58.7 per cent. Walking capacity within six months was established in 11 out of 16 in children, 62.5, and in adults 6 out of 17, 35.5 per cent. In group II, complete recovery occurred in children in 14 out of 14, 100 per cent, and in adults in 14 out of 18, 78.3 per cent. Walking capacity within six months was established in children in nine out of 14, 64.2 per cent, and in adults in nine out of 18, 50.0 per cent.

### *The Duration of the Spinal Symptoms (until Operation)*

In group I, complete recovery occurred in 16 out of 21, 76.2 per cent, in patients with duration of the spinal symptoms of less than two years and in seven out of 12, 58.3 per cent, in patients with longer symptoms. Walking capacity showed no difference. In group II, duration of the spinal symptom had no influence either upon the quality of recovery or upon the rapidity in regaining walking capacity.

*The grade of paraplegia.* In group I, complete recovery occurred in 18 out of 27, 66.6 per cent, in patients with complete paraplegia and in five out of six, 83.3 per cent, in incomplete paraplegia. In group II, complete recovery occurred in 19 out of 23, 82.6 per cent, in patients with complete and in nine out of nine, 100 per cent, in incomplete paraplegia.

*The type (early or late) of paraplegia.* In this series the type of paraplegia seems not to affect the results of treatment. In group I, complete recovery occurred in 19 out of 27, 70.4 per cent, in patients where the onset of paraplegia was two years or within two years from the beginning of the spinal symptoms as compared to four out of six, 66.6 per cent, in patients with more than two years. Walking capacity within six months was established in patients with early paraplegia as compared to three out of six, 50.0 per cent, in patients with late paraplegia. In group II, complete recovery occurred in 24 out of 27, 88.8 per cent, in patients with early paraplegia and in four out of five, 80.0 per cent, in late. Walking capacity within six months was established in 14 out of 27, 50.4 per cent, in early and in four out of five in late.

*The duration of paraplegia.* In this series the duration of paraplegia seems to affect the result of treatment. In group I, complete recovery was shown in 18 out of 23, 78.3 per cent, of patients with one year and less duration of paraplegia as compared to five out of 10, 50.0 per cent, recovery in patients where the duration of the paraplegia was more than one year. Walking capacity was established in 13 out of 23, 56.5 per cent, in patients with paraplegia of short duration and in four out of 10, 40.0 per cent, with long duration. In group II, duration of paraplegia had no effect upon the quality of recovery, complete recovery occurred in 21 out of 24, 87.5 per cent, in patients with less than one year of paraplegia and in seven out of eight, 87.5 per cent, with a longer period. Walking capacity occurred within six months in 16 out of 24, 80.0 per cent, in patients with less than one year of paraplegia and in two out of eight, 25.0 per cent, with longer.

*The cause of compression.* The numbers in the different groups are too small to justify a definite statement. It is interesting to note, however, that all patients with compression by solid agent recovered completely after the compressing agents were removed thoroughly. On the other hand these patients needed much longer time to gain walking capacity. Walking capacity occurred within six months in 2 out of 7, while in 5 it took 11 to 27 months.

#### DISCUSSION AND CONCLUSION

The grade of paraplegia and the duration of paraplegia were not inter-related in the reported series. In the majority of cases total paraplegia developed a short time after the appearance of neurological symptoms. Plain X-rays and tomograms were of little help in elucidating the cause

of paraplegia. On the other hand myelography gave valuable information in elucidating the cause of compression. The extent of the spinal lesion was often found at operation to be more extensive than plain radiography suggested. Increased paravertebral soft tissue shadow on radiography indicating the presence of abscess could not always be verified at operation.

The transthoracic and the thoraco-abdominal approach used in group II in connection with anterior spinal fusion gives an excellent view of the diseased part of the spine.

The commonest cause of compression in early paraplegia was found to be inflammatory products and sequestered material, while in late paraplegia the cause was most often found to be purely mechanical. One of the characteristic features of the pure mechanical compression was a compact intra-spinal fibrosis and adhesions, consequently the dura was tightly fixed to the walls of the spinal canal, furthermore almost always a bony spur or a ridge was found to be the compressing agent.

Kyphosis in itself rarely produced a compression. An astonishing degree of deformity may develop without any involvement of the cord.

The approach used in group I did not always give sufficient information about the extension of the tuberculous process and the compressing agent. This method of operation, however, gave good results especially in early developing paraplegia of short duration. The transthoracic evacuation of tuberculous tissue in connection with anterior spinal fusion gave somewhat better results as far as complete recovery from paraplegia was concerned and in late paraplegia. Especially in cases where the compressing agent was formed by solid masses, this method seems to be superior. This operation furthermore makes possible stabilisation of the spine when many vertebrae are involved and extensive curettage is needed. Anterior spinal fusion is an exacting surgical intervention, however, necessitating thoracotomy and more thorough post-operative care. Antituberculous drugs have naturally to be given in connection with both of these operative procedures.

#### S U M M A R Y

Two practically similar groups of Pott's paraplegia, altogether 65 cases, are reported. In group I radical evacuation of tuberculous tissue was performed through an antero-lateral cervical incision or through costo-transversectomy. In group II the tuberculous tissue and the surround-

ing part of the vertebra and disc were removed in connection with anterior spinal fusion. In this group an artero-lateral cervical approach and a transthoracic or a thoracoabdominal approach were used.

The operative findings and the treatment results are compared and discussed. The transthoracic approach gave an excellent opportunity to inspect and to remove the compressing agent and seems to be preferable in cases of longstanding paraplegia, where the compressing agent is often formed by solid masses.

This approach furthermore makes it possible at the same time to stabilise the spine by anterior fusion.

#### RESUME

Deux groupes pratiquement similaires de paraplégie de Pott, en tout 65 cas, sont rapportés. Dans le groupe I, il a été pratiqué une extirpation radicale du tissu tuberculeux par incision cervicale antéro-latérale ou par costo-transversectomie. Dans le groupe II, le tissu tuberculeux et l'entourage de la vertèbre et du disque intervertébral ont été retirés en liaison avec une fusion spinale antérieure. Dans ce groupe, on a eu recours à une approche antéro-latérale cervicale, une transthoracique ou une thoracoabdominale.

Les trouvailles opératoires et les résultats du traitement sont comparés et discutés. L'approche transthoracique a donné une excellente possibilité d'examiner et d'éliminer l'agent de la compression et semble être préférable dans les cas de paraplégie de longue durée où l'agent de compression est souvent formé de masses solidifiées.

Cette approche permet en outre de stabiliser simultanément la colonne vertébrale par fusion antérieure.

#### ZUSAMMENFASSUNG

Über zwei fast gleichartige Gruppen von Pott'scher Paraplegie, insgesamt 65 Fälle, wird berichtet. In der ersten Gruppe wurde eine radikale Entfernung von tuberkulösem Gewebe mittels einer antero-lateralen, cervikalen Inzision oder mittels Costo-transversektomie ausgeführt. In der zweiten Gruppe wurden das tuberkulöse Gewebe und der umgebende Teil des Wirbels und des Diskus im Zusammenhang mit einer vorderen Wirbelversteifung entfernt. In dieser Gruppe wurde ein antero-lateraler, cervikaler Zugang, ein transthorakaler oder ein thorakoabdominaler Zugang verwendet.

Die operativen Befunde und Behandlungsergebnisse werden verglichen und besprochen. Der transthorakale Zugang gab eine ausgezeichnete Möglichkeit das komprimierende Agens zu inspizieren und zu entfernen und scheint bei Fällen von langdauernder Paraplegia, in denen das komprimierende Agens oft von soliden Massen gebildet wird, vorzuziehen zu sein.

Dieser Zugang macht es ausserdem möglich die Wirbelsäule gleichzeitig mittels vorderer Fusion zu stabilisieren.

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