

SURVIVAL TIME IN PARAPLEGICS WITH CERTAIN URINARY COMPLICATIONS

By I. NUSEIBEH, F.R.C.S. and R. G. BURR, Ph.D., F.R.S.C.
National Spinal Injuries Centre, Stoke Mandeville Hospital, Aylesbury, Buckinghamshire, England.

Abstract. The clinical records of 1025 patients admitted to the National Spinal Injuries Centre between 1944 and 1969, (and who later died), were reviewed. Average survival times were obtained following the occurrence of a stone in the urinary tract and following the onset of proteinuria, reduced creatinine clearance and elevated serum creatinine.

The case records of a further 388 patients admitted during 1950, 1955 and 1960 but thought to be still living were reviewed for comparison. Their known life span following the onset of the complications studied did not differ from those of the deceased patients in the survey.

Key words: Spinal paralysis; Life expectancy; Urinary tract complications.

Introduction

THE doctor caring for the patient with a spinal cord lesion is frequently called upon to express an opinion as to how much the patient's life is likely to be shortened because he is paralysed.

Nyquist and Bors (1967-68) found that survival in traumatic paraplegics depended on the age of the patient at the time of the accident as well as on the level of the spinal cord lesion and also whether it was complete or incomplete. To these factors Hardy (1976-77) added the delay before admission to hospital after injury. The patient's motivation and family support were mentioned by Carter (1979-80) and to these we would add regular medical examination and prompt re-admission to a spinal unit if complications arise.

One of the common causes of death in late paraplegia is renal failure. We therefore reviewed the records of creatinine clearance, serum creatinine and urinary protein levels and of urinary stone occurrences. By studying these data in patients with known survival time (those who have died), we have tried to obtain information about the relationship between renal disease and survival time.

Material and Methods

The number of patients admitted to the NSIC during the period 1944 to 1969 was 4688. Of these 1025 are known to have died and are the main subject of this review (Table I). The dates of onset of spinal cord lesions ranged from the year 1913 to 1969. The delay between onset and admission to the NSIC was from a few hours to 50 years; 50 per cent were admitted within one year and 75 per cent within 4 years of onset of the spinal cord lesion.

TABLE I

Year of Admission	Number of Patients	
	Total Admitted	Deceased
1944-9	520	259 (50%)
1950-4	690	243 (35%)
1955-9	890	167 (19%)
1960-4	1340	202 (15%)
1965-9	1248	154 (12%)
	4688	1025

So that a comparison could be made between the deceased patients and some who were thought to be still living the years 1950, 1955 and 1960 were selected arbitrarily and the medical records of all admissions were reviewed. From these three years 388 patients were still living and 128 had died.

Of the 1025 deceased patients, 873 were male and 152 female. 689 were traumatic, the remainder being non-traumatic in origin. The levels of the traumatic lesions were: cervical 72 complete, 114 incomplete; thoracic 316 complete, 66 incomplete; lumbar 100 complete, 49 incomplete. Of the non-traumatic cases 90 were progressive illnesses such as disseminated sclerosis or malignant disease and 218 were non-progressive illnesses (transverse myelitis, poliomyelitis, spinal abscess, disc lesion, vascular anomaly, spinal deformity, spina bifida, iatrogenic, etc.).

The results of post mortem examination were available in 320 patients. In 268 (84 per cent) renal failure was a major cause of death. The number of patients known, on the basis of regular radiological examination and/or post mortem findings not to have formed a stone in the urinary tract, was 334. The number of patients who formed stones in the upper urinary tract only was 120, in the bladder 86, and in both bladder and upper urinary tract at the same or different times 84, an association that was highly significant ($P < 0.001$). Bilateral renal calculi occurred in 80 patients. In 401 no calculi were recorded but surveillance was inadequate.

The proportion of patients with renal stones, expressed as a percentage of the total number in each year with adequate surveillance was as follows: 1941, 45 per cent; 1951, 21 per cent; 1961, 15 per cent; 1969, 12 per cent. Table II shows the distribution of times when stones were first observed. For bilateral calculi the time of onset was taken to be the time when a stone was discovered in the second kidney, the other kidney being simultaneously or previously affected.

In 234 patients the date of death was not known, and these, together with a further 143 patients with spina bifida or progressive illnesses, or who died from associated injuries, pulmonary embolism, accident or suicide were excluded from further study. The number of patients available for survival time study was therefore 648. No patient received a renal transplant or dialysis.

For the urinary stone data patients were also excluded if the date of first occurrence of the stone was uncertain, or if the stone was present prior to 1944.

TABLE II
Interval Between Onset of Spinal Cord Lesion and Detection of Calculus

	Number Of Patients	Percentage of Stone-Forming Patients		
		25% occurred within	50% occurred within	100% occurred within
Bladder stones	91	1 year	3 years	33 years
Kidney stones	89	3 years	9 years	33 years
Bilateral kidney stones	41	6 years	11 years	31 years

Data up to 1953.

Twenty-four hour urinary protein excretion was usually determined at the same time as creatinine clearance which was introduced as a routine procedure at the NSIC at the beginning of 1964. There were 841 urinary protein results obtained from 286 patients and 1120 creatinine clearance results obtained from 268.

The attempt was made to determine the dates when urinary protein excretion first exceeded 5 and 10 g per 24-hours, when creatinine clearance fell below 50, 25 and 10 ml/min, and when the serum creatinine concentration exceeded 170, 250 and 480 mmol/l for men and 115, 175 and 340 mmol/l for women. These values were chosen arbitrarily to represent different degrees of renal impairment, the different values of serum creatinine for men and women being based on the known differences in creatinine production and glomerular filtration rate between the sexes. With severely impaired states of renal function two situations were recognised; firstly, temporary impairment followed by some degree of recovery; secondly, permanent renal failure with no recovery.

Survival time was analysed first in relation to the year when the urinary complication considered was first observed. Maximum survival time for the complication in question was subtracted from 1981, the date of our study. Occurrences of the complication after the year so calculated were excluded from further analysis. The remaining data were analysed in relation to the age of the patient when the complication was observed. The patients were divided into ten-year age groups and the average age and survival time calculated for each one. From these figures average survival time at age 25, 35, 45, 55 and 65 years were obtained graphically.

Results

The survival time data for patients with urinary calculi are given in Table III. It is interesting to note that there were no female patients or patients with complete cervical lesions among them.

Table IV gives the survival times for patients with proteinuria of 5 or more grammes per day. The figures for a protein excretion of 10 g/day or more were not appreciably different.

Survival times for patients with varying levels of creatinine clearance are given in Table V and for serum creatinine in Table VI.

No differences in survival time related to level or completeness of cord lesion or the sex of the patient were apparent in any part of this survey.

TABLE III
Survival Times for Patients with Stones. Interval
between Detection and Death.

Age at Detection	Mean Survival Time (years)	
	Bladder Stones	Kidney Stones
	n = 57	Unilat. n = 86
		Bilat. n = 30
25	18	14
35	13	10
45	9	9
55	5	5
65	2.5	2.5

n refers to the number of patients

TABLE IV
Survival Times for Patients Excreting 5 or More
Grammes of Urinary Protein per 24 hours.
Interval Between First Report of 5 g Proteinuria
and Death. 46 Patients Included

Age When Proteinuria Reported	Mean Survival Time (years)
25	3.5
35	2.8
45	2.2
55	1.5
65	0.9

TABLE V
Survival Time in Relation to Creatinine Clearance. Interval Between Time
of Observation and Death.

Age of Observation	Mean Survival Time (years) When Creatinine Clearance =				
	50 ml/min n = 51	25 ml/min n = 48	10 ml/min n = 28		
		Temporary Episode	No Recovery	Temporary Episode	No Recovery
25	6	7.2	2.3	4.2	1.6
35	4.9	5.9	2.0	3.5	0.9
45	3.7	4.6	1.8	2.9	0.5
55	2.6	3.3	1.4	2.2	0.3
65	1.4	2.0	1.2	1.6	0.2

n indicates the number of patients included in each group

TABLE VI

Survival Time in Relation to Serum Creatinine. Interval Between Time of Observation and Death.

Age of Observation	Mean Survival Time (years) when Serum Creatinine =				
	170 mmol/l (males) 115 mmol/l (females) n = 47	250 mmol/l (males) 175 mmol/l (females) n = 44		480 mmol/l (males) 340 mmol/l (females) n = 37	
		Temporary Episode	No Recovery	Temporary Episode	No Recovery
25	4.4	6	1.2	3.5	1.3
35	3.6	5	1.2	3.1	0.6
45	2.9	4	1.2	2.7	0.5
55	2.2	3.1	0.7	2.3	0.4
65	1.4	2.2	0.3	1.9	0.3

n indicates the number of patients included in each group

For the three arbitrarily selected years 1950, 1955 and 1960 for which patients who were still living were reviewed, their period of known life-span following the occurrence of calculi, the onset of proteinuria or renal impairment were within the range of survival times of the deceased patients, and the two sets of data did not differ significantly.

Discussion

This was a study of deceased patients taken from a population the majority of whom were still living. The results would be erroneous if there existed (in the 'still living' group), patients with calculi, proteinuria or renal dysfunction with survival time following the onset of the complication greater than that of the deceased patients with the same complication. This possibility is excluded, with reasonable certainty, by the results obtained from the small group of 'still living' patients whose case notes were reviewed.

From Table III it appears that (although a bladder calculus does not kill a patient), survival time is shortened, particularly in the higher age groups. In the case of a kidney stone survival times were shorter than for a bladder stone in the younger age groups. Only when kidney stones occurred bilaterally were survival times in the younger age groups reduced still further. We consider that when a patient has a urinary calculus other common complications of paraplegia such as pressure sores, may occur and have an additional effect upon survival.

A urinary protein excretion of five or more grammes daily was related to markedly reduced survival (Table VI) and gave essentially the same survival times as 10 g proteinuria. It was noticed that lower values of proteinuria (but still over 5 g per day), sometimes occurred following previous very high values. This may have indicated progression of the

disease rather than improvement. In many of these cases a diagnosis of amyloidosis was confirmed histologically.

The figures for survival time obtained for patients with impaired creatinine clearance or with elevated serum creatinine concentration (Tables V and VI) indicate an increasingly poor prognosis with more severely impaired renal function.

Others have reported that the survival of a spinal patient depends on the level and completeness of the cord lesion and on the sex of the patient (Nyquist and Bors, 1967-68). The reason this was not observed in the present study was probably because (in the presence of the urinary complications considered), survival time was already short. In addition, the numbers of patients in the various groups were small.

The survival times reported in this paper are descriptive of the population of patients studied at the NSIC during the period specified. This period included the early years when the modern management of spinal cord injuries was in its infancy and when great advances were being made in management. The results are not, therefore, strictly applicable to other groups of patients treated at this or any other centre.

SUMMARY

The clinical records of 1025 patients admitted to the National Spinal Injuries Centre (NSIC) between 1944 and 1969 and who have subsequently died, were reviewed. Average survival times were obtained following the occurrence of calculi in the bladder or one or both kidneys and following the onset of proteinuria, reduced creatinine clearance and elevated serum creatinine.

The records of a further 388 patients admitted during 1950, 1955 and 1960 (but thought to be still living), were reviewed for comparison. Their known life-spans following the onset of the complications studied did not differ from those of the deceased patients in the survey.

For patients with calculi the average survival times were long, varying from 18 years for a bladder stone at age 25 to 12 years for bilateral renal calculi at the same age. Shorter times were observed for higher ages down to 2.5 years for all categories of calculi at the age of 65.

For patients with proteinuria exceeding 5 g per day the survival times varied from 3.5 years at age 25 to 0.9 years at age 65.

Survival times corresponding to the different creatinine values were in the following ranges: creatinine clearance 50 ml/min, survival time 6 years at age 25 to 1.4 years at age 65; creatinine clearance 10 ml/min, survival time 1.6 years at age 25 to 0.2 years at age 65. Similar figures were obtained for appropriate elevations of serum creatinine.

RÉSUMÉ

Les registres cliniques de 1025 malades admis au National Spinal Injuries Centre entre 1944 et 1969 qui moururent ensuite étaient considérés. Les déais moyens de survivance après l'occurrence d'un calcul de l'urètre, après une attaque d'azoturie, réduction d'excrétion de créatinine et augmentation de créatinine sérique.

Les registres de 388 autres malades admis pendant 1950, 1955 et 1960 desquels la survivance était présumée étaient considérés pour comparaison. La période de survivance constatée après d'attaque des complications étudiées n'était point différente de celle des malades morts considérés.

ZUSAMMENFASSUNG

Die Nachforschung der Lebensläufe von 1025, inzwischen verstorbenen Patienten, aufgenommen in den Jahren 1944 bis 1969 im National Spinal Injuries Centre, ergab eine durchschnittliche Überlebenszeit. Es traten Komplikationen auf, wobei wir uns mit Komplikationen im Harntrakt durch einen Stein, die zur Folge einen Anfall von Proteinurie, zurückzuführen auf eine Creatininfreilegung und erhöhtem Creatininserum hatte, beschäftigt haben. Weitere Nachforschungen von Lebensverläufen von 388, noch lebenden Patienten, aufgenommen während den Jahren 1950, 1955 und 1960 ergab, zurückblickend, keine wesentlichen Unterschiede von Komplikationsangriffen zu denen im Vergleich der oben genannten Verläufe.

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