



Audit of a British Centre for spinal injury

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The aim of this study was to determine the benefits of patients admitted early to the specialist spinal injuries centre. The results show a significant reduction in the incidence of pressure sores in the early admitted patients and demonstrate the lowered incidence of both preventable and non preventable complications, as well as reduction of hospitalisation time.

Keywords: spinal cord injury; early, delayed and late admissions; medical complications; length of stay; audit

Introduction

Spinal Injuries Centres are now well established in the United Kingdom and are equipped to resuscitate, manage and rehabilitate patients with traumatic and non traumatic spinal paralysis as well as provide a life long follow up and management for these patients.¹ One of the major activities of Spinal Injuries Centres is the prevention of complications related to the multi-system impairment caused by the spinal paralysis both in the short and long term. Delays in the transfer of spinal injured patients to the specialist care may have an adverse effect on the outcome of the patient and the development of complications eg pressure sores, bladder problems etc, as well as result in prolonged hospitalisation times.^{2–6}

This study has been designed to examine the relationship between the delay in admission to the Centre and the development of complications during the first post traumatic period of hospitalisation. The study is limited by the lack of accurate pre-admission information and the lack of information on morbidity and mortality of patients not referred to the Centre.

Methods

The Midlands Centre for Spinal Injuries has 45 beds to serve the Midlands, North Wales, Mid Wales and South Mersey (about 7.5 million population). At any one time about 30 beds are occupied by newly paralysed patients and the other 15 for re-admission and life long review from a total of about 1500 patients. A retrospective study was carried out on the case notes of all new admissions to the Midlands Centre for Spinal Injuries between January 1985 and

December 1988. The follow up period ranged between 2 and 5 years. A total of 322 first admissions was recorded during this 4 year period. The patients' characteristics are shown in Table 1.

About 18% of the patients had paralysis of non traumatic origin. There were 219 patients with spinal paralysis in the trauma group, of which 173 were male, with an average age of 35.5 years and 46 females, with an average age of 44.2 years. Forty two patients with intact neurology and four patients with conversion reaction were excluded.

An analysis of the cause of injury revealed that road traffic accidents account for about 50% of these injuries (Table 2). Fifty three per cent of the patients had locomotor as well as a multi-system impairment from the neck downwards (Table 3). The incidence of double fractures of the spinal axis was previously documented by Gupta and El Masry⁷ in 1989 and in this series it was also found to be 9%. About 30% of the patients had associated injuries: 25 patients (11.4%) had haemo pneumothorax; 32 patients (14.6%) had skeletal fractures (limbs, ribs, sternum, clavicle, pelvis, skull); four patients (1.8%) had traumatic brain injury; one patient (0.45%) had a brachial plexus injury; one patient (0.45%) had a ruptured aorta. In spite of these associated injuries the clinical outcome was not affected adversely as there was no neurological deterioration on the Frankel scale.

The patients were divided into three groups.

Group 1

Early admission when the patients were admitted within 1 week of injury.

Group 2

Delayed admission when patients were admitted over 1 week but within 2 months from injury. Usually the

Table 1 Patients' characteristics

<i>Traumatic Spinal Injury</i>	
Cord injury with paralysis	219
Bony injury with intact neurology	42 (Excluded)
Conversion reaction	4 (Excluded)
Non Traumatic Spinal Lesion	57 (Excluded)

Table 2 Causes of injury

Road traffic accident	110
Falls; Domestic and industrial accidents	93
Sporting injuries	16

Table 3 Level of bony injury

Cervical	116 patients (53%)
Thoracic	73 patients (33.3%)
Lumbar	30 patients (13.7%)

Of these, 20 patients (9%) had double fractures

delays were due to difficulties in transfers or unavailability of beds on the Midlands Centre for Spinal Injuries.

Group 3

Late admissions when patients were admitted over 2 months from injury (Table 4).

Over 70% of patients were admitted within 1 week of injury, 20% within 2 months of injury and only 8.7% of patients were admitted after 2 months. Late admissions were usually due to late referrals.

The Midlands Centre for Spinal Injuries has a multi-disciplinary team of Doctors, Nurses, Physiotherapists, Occupational Therapists, a part-time Psychologist and a Social Worker to deal with the multi-system impairment as well as the psycho-social support and psycho-social engineering required for the resettlement in the community.

An 'injury to grave' service as described by Guttman and others¹⁴ is offered to all patients and accepted by the majority.

The Centre has a 24 h telephone consultation service to advise on management prior to acute admission, following discharge and if necessary, prior to re-admission for treatment or further rehabilitation. A team of three hospital based Liaison Officers commence the resettlement process from a very early stage. Hence the majority of patients were discharged to their own homes in the community. Only 6% of the patients were discharged to other hospitals and nursing homes (Table 5).

Results

Table 4 shows the median values for average total hospitalisation from accident to discharge for each of

Table 4 Delay in admission and average total hospitalisation

<i>Delay in admission</i>	<i>Paraplegia</i>		<i>Tetraplegia</i>	
	<i>Number of patients</i>	<i>Average hospitalisation in weeks</i>	<i>Number of patients</i>	<i>Average hospitalisation in weeks</i>
Group 1	67 (30.60%)	19	88 (40.2%)	22
Group 2	25 (11.4%)	22	20 (9.1%)	25.25
Group 3	11 (5%)	74	8 (3.7%)	41.75

Table 5 Discharge destinations

<i>Home</i>	<i>Other hospitals and nursing homes</i>	<i>Deaths</i>
198	12	9

the patients' groups. To compare the average hospitalisation length between the groups for paraplegic and tetraplegic patients, the Kruskal-Wallis one-way analysis of variance was used. This test reveals that there is evidence that the average hospitalisation of paraplegic patients varies between the three groups ($P < 0.001$). Multiple comparisons between groups suggest that there are differences between groups 1 and 3, and between groups 2 and 3, but not between groups 1 and 2. For the tetraplegic patients the Kruskal-Wallis test again suggests that the average hospitalisation varies across the groups ($P = 0.0074$). Multiple comparisons between groups suggest that the only significant difference is between groups 1 and 3. The small numbers of patients is probably the reason why the comparison between groups 2 and 3 failed to reach statistical significance. For the multiple comparisons, the test of significance were carried out at the 5% level and a significance difference implies $P < 0.05$ and non-significance that of $P > 0.05$.

Regarding secondary complications there were no statistically significant differences in the incidence of most recognised problems for patients in the three groups. There was however, one statistically significant finding (standard error of difference between percentages test). Early admission patients with paraplegia in group 1 were less likely to develop pressure sores compared with group 2, 3 or groups 2 and 3 combined ($0.05 > P > 0.01$, $0.05 > P > 0.01$, $P > 0.01$). Similarly in the tetraplegic population the earlier admitted group 1 had lower incidence of pressure sores compared with group 3 or groups 2 and 3 combined ($P < 0.01$, $P < 0.01$).

Our Centre does not use or advise about the use of high doses of methylprednisolone in the acute stage following injury.

Discussion

The data in Table 6 lists the different complications encountered among the patients. The complications

Table 6 Secondary complications of spinal cord injury during initial hospitalisation-comparison of early, delayed and late admissions

Complications	Paraplegia			Tetraplegia				
	Group 1 n=67	Group 2 n=25	Group 3 n=11	Group 2+3 n=36	Group 1 n=88	Group 2 n=20	Group 3 n=8	Group 2+3 n=28
1 Deep Vein Thrombosis	3 (4.5%)	1 (4%)	–	1 (2.8%)	2 (2.3%)	–	–	–
2 Pulmonary Embolus	–	–	–	–	1 (1.1%)	–	–	–
3 Pressure Sores	1 (1.5%)	5 (20%)*	3 (27.3%)*	8 (22.2%)**	1 (1.1%)	1 (5%)	4 (50%)**	5 (17.9%)**
4 Contracture	–	–	–	–	–	–	2 (25%)	2 (7.1%)
5 Heterotopic Ossification	1 (1.5%)	–	1 (9.1%)	1 (2.8%)	2 (2.3%)	1 (5%)	–	1 (3.6%)
6 Broncho-pneumonia	2 (3%)	–	–	–	5 (5.7%)	3 (15%)	–	3 (10.7%)
7 Respiratory Failure	–	–	–	–	1 (1.1%)	–	–	–
8 Cardiac Arrest	–	–	–	–	6 (6.8%)	–	–	–
9 Perforated DU.	–	–	–	–	1 (1.1%)	–	–	–
10 Epididymo-orchitis	1 (1.5%)	–	–	–	1 (1.1%)	1 (5%)	–	1 (3.6%)
11 Septicaemia	–	1 (4%)	–	1 (2.8%)	–	1 (5%)	–	1 (3.6%)
12 Bladder Stone	2 (3%)	2 (8%)	2 (18.2%)	4 (11.1%)	–	1 (5%)	–	1 (3.6%)
13 Depression needing treatment	3 (4.5%)	2 (8%)	–	2 (5.6%)	4 (4.6%)	1 (5%)	–	1 (3.6%)
14 Hydronephrosis	–	–	2 (18.2%)	2 (5.6%)	–	–	–	–

0.05 > P > 0.01*, P < 0.01**

involving the venous system remain a major site of morbidity and mortality in patients with an acute spinal cord injury. The Table indicates a slightly higher risk for development of deep vein thrombosis among early admitted patients than among late admissions despite routine anticoagulation at the Centre. However this was not of statistical significance and we have no information about deep vein thrombosis and death from pulmonary emboli in patients not referred to the Midlands Centre for Spinal Injury.

Cardiac arrest among high tetraplegic patients was a relatively common complication and related to the very old.^{8,9} The number of patients over the age of 60 years was 37. All patients were closely monitored with comprehensive ITU like supervision.¹⁰ Atropine was given routinely whenever the heart rate fell below 50 per min. Despite the intervention 6.8% of tetraplegic patients had a cardiac arrest which indicates the more severely disabled patients being admitted early.¹¹ Unfortunately there is no mechanism to find out how many patients died before transfer to the Centre.⁸

There was a statistical significant increase in pressure sores when transfer to the Midland Centre for Spinal Injury was delayed for over a period of 1 week. This is similar to the findings in the University of Michigan study.¹² The high risk for development of contractures in the 3rd group⁶ was also identified though not of statistical significance. The musculoskeletal complications can be prevented by early

involvement of the rehabilitation professionals during the acute phase of care in specific stretching programmes.

The incidence of heterotopic ossification was small and insufficient for analysis.¹³ We do not know the true percentage of the complication in patients treated outside the Spinal Injury Centre.

Urological complications such as hydronephrosis, bladder stones and epididymo-orchitis occurred at a reduced frequency when patients were admitted early, undoubtedly reflecting advances in urological management and early widespread use of intermittent catheterisation.¹⁴ None of the patients developed urethral fistula. The importance of regular urological follow up has been reinforced in this population between 1985 and 1988.

Conclusion

In conclusion patients admitted early to the specialist Spinal Centre have a significantly lower risk of developing pressure sores. The incidence of other complications related to the multi-system impairment is relatively low considering that no prophylactic antibiotics were given. The true comparative incidence of these complications in patients treated outside the Spinal Injury Centre is unknown. The death rate in patients treated outside the Spinal Injury Centre is also unknown.



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