Medication usage in a spinal cord injured population

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The patterns of medication usage in persons with a spinal cord injury (SCI) in a residential facility have been studied. This population averaged over eight (8) medications per person, took 70% of this medication from five (5) therapeutic categories (MIMS) and thus took multiple medications from individual categories. This level of medication usage is higher than what has been published for elderly populations, who are considered 'at risk' of medication misadventure. The SCI population was predominantly young and as yet, taking few medications for treating age related conditions. Thus, the level of medication use might be expected to increase further in this population.

Keywords: spinal cord injury; medications

Introduction

Spinal cord injury can result from an illness process or from trauma. The results of such injuries are variable depending upon whether the cord is severed or crushed, the site of injury of the spinal cord, associated injuries and concurrent pathology.^{1–13} There is no definitive treatment for spinal cord injury at present.

Medications contribute to patient care.^{14–16} This study has been conducted to examine medication usage patterns, and to consider some of the implications of such patterns in a spinal cord injured population.

Method

This study was undertaken at the Quadriplegic Centre in Western Australia. This is a one hundred bed specialist nursing facility offering comprehensive services for both short and long term accommodation and care.¹⁷ There were 88 residents at the time of the study. Data were gathered from medical records and medication charts over a 28 day period.

Analysis

The data were analyzed via the statistical package SPSS-X (18) using standard statistics.¹⁹

Medication usage was examined in terms of:

- total number of medications used
- therapeutic categories containing these medications
- percentage of residents taking multiple medication from each category

These factors were studied for:

- the total population
- gender groups
- age groups
- mode of injury groups (illness vs trauma)
- groups according to level of spinal cord injury

Results

Demographics

The study population is presented in Table 1. The majority of residents were young, male, and suffered high level traumatic injuries. The group designated 'others' had a variety of conditions not associated with a definite level of injury along the spinal cord. This has been reported elsewhere in more detail¹⁷ and is in agreement with other literature reports.^{11,20,21}

Number of medications and therapeutic categories

Total population The medications used fell into 14 categories under the MIMS therapeutic classifications²² (Table 2).

A total of 727 medications were used over the 28 day period, representing 157 different medications, at an average of 8.26, and a range of 0–20, medications per resident.

SCI persons, like other grouped populations such as the elderly,^{23–27} have a number of medical problems, and thus medications, in common. SCI impacts on the central nervous system (CNS), alimentary, genito-urinary and musculoskeletal systems, and medication addressing these systems accounted for over 60% of all medications used.

The large number of CNS medications used arose from the relatively widespread use of diazepam,

analgesics, antidepressants and anticonvulsants. In some instances, medications were used for purposes other than for their primary indication. Anticonvulsants were used to treat neurogenic pain, antidepressants for phantom and atypical pain and diazepam for control of muscle spasm.^{9,10} The CNS category also encompasses a diversity of medications targeting other systems, for example, the antinauseants.

The high use of alimentary medication reflected laxative measures. Genitourinary medication was typically a hexamine salt with the urinary acidifier ammonium chloride. Musculoskeletal medication was in common use due to the incidence of muscle spasm, which if not treated with diazepam, was treated with baclofen, or in some instances, both.

Cardiovascular medication was the fifth largest category due to inclusion of two items, these being prazosin and phenoxybenzamine, however, these items were used to aid in urinary voiding.

Over 70% of all medication came from five therapeutic categories and was set by a number of individual items prescribed for some of the most common sequelae of SCI.

Gender groups Female residents averaged more medications per person than males, but this was not

Table 1 Population demographics

	Males n = 59	Females n = 29	Total n = 88
Under 65	45	15	60
65 and over	14	14	28
Illness	11	21	32
Trauma	48	8	56
C Level	43	5	48
T Level	9	5	14
L Level	2	3	5
Other	5	16	21

statistically significant. (Table 2).

Male residents averaged more cardiovascular ($P=90\%$) and genitourinary ($P=99\%$) medications, and female residents averaged more CNS ($P=80\%$), hormonal ($P=98\%$) and ocular ($P=98\%$) medications per person. Use of cardiovascular and genitourinary medications reflected management of the direct consequences of SCI. This indicates that more male residents had medical problems related to their SCI, while female residents had more diverse problems in addition to their SCI, and/or had fewer problems associated with their SCI.

Age groups Those residents 65 years of age and over required more ($P=99\%$) medications than those under 65 (Table 2), particularly alimentary ($P=99\%$),

Table 3 Therapeutic categories of medication taken by Level of injury groups ($n=88$)

Therapeutic category	Number of medications taken			
	L Level n = 5	T Level n = 14	C Level n = 48	Others n = 21
Central Nervous System	16	23	106	44
Alimentary	4	24	75	30
Genitourinary	2	14	51	11
Musculoskeletal	2	12	43	12
Cardiovascular	4	5	34	9
Nutrition	2	11	26	11
Respiratory	1	11	29	4
Antiinfective	0	5	18	7
Hormonal	1	3	11	8
Haematinic	1	1	11	6
Skin	4	1	5	7
Allergy	3	0	8	1
Ocular	0	1	3	3
Antineoplastic	0	0	1	2
Total	40	111	421	155

Table 2 Therapeutic categories of medication taken ($n=88$)

Therapeutic category	Males n = 59	Females n = 29	Number of medications taken		Total n = 88
			< 65 years n = 60	65+ n = 28	
CNS	114	75	115	74	189
Alimentary	87	46	75	58	133
Genitourinary	67	11	55	23	78
M/skeletal	44	25	38	31	69
C/vascular	41	11	33	19	52
Nutritional	35	15	31	19	50
Respiratory	31	14	27	18	45
Antiinfective	19	11	23	7	30
Hormonal	10	13	17	6	23
Haematinic	11	8	9	10	19
Skin	12	5	12	5	17
Allergy	7	5	6	6	12
Ocular	1	6	2	5	7
Antineoplastic	1	2	1	2	3
Total	480	247	444	283	727

haematinic ($P=90\%$), musculoskeletal ($P=99\%$) and ocular ($P=90\%$) medications. The greater use of musculoskeletal medication by older residents was due to non-steroidal antiinflammatory, not baclofen, use. Older residents, like female residents, used more of those medications not particularly indicative of SCI.

Level of injury groups Residents with cervical level injuries required the largest number of medications per person, while those in the 'others' group, the least, but there were no statistically significant differences between these groups (Table 3).

Those with high level injuries used more medications related to problems related to SCI, while those with lower injuries, head injuries or nonspecific levels of injury used a more diverse range of medication. Most residents with high levels of injury were young, male and injured traumatically.

Mode of injury groups While the number of medications per person did not vary significantly between these groups, the pattern of medication use did, with 75% of all medication for those injured traumatically coming from the five major categories of medication, compared with 66% for those with illness. Only 8.2% of medication for those traumatically injured came from the six smallest categories (not indicative of SCI) compared with 13.6% for those with illness. This demonstrated the expected bias in medication usage between trauma-

tically and non-traumatically injured residents. This bias continued with the individual medications required by these two groups of residents (Table 4). Usage of 'SCI indicative' medications, on a per person basis, was 2–20 times greater in residents injured traumatically.

Use of multiple medications from therapeutic categories Several residents required multiple medications from individual categories. Of the 88 residents, 11 (12.5%) required five or more drugs from any one therapeutic category (Table 5).

Use of multiple CNS medications was due to the diversity of medications in this category. Multiple alimentary medication use was due to the large number of residents using laxatives. Many residents were on the duo of hexamine and ammonium chloride, which must be given together for effect.

Significantly more female residents required multiple CNS ($P=80\%$) (due to diverse medical problems), while more male residents ($P=99\%$) required multiple genitourinary medications (due to hexamine and ammonium chloride usage (Table 6).

With the exception of genitourinary medications ($P=80\%$), a larger number of older residents required multiple drug therapy compared with younger residents. This was significant for CNS ($P=90\%$), alimentary ($P=99\%$) and musculoskeletal ($P=95\%$) medications (Table 6).

Table 4 Number of residents using spinal cord injury specific medication ($n=88$)

Medication	Trauma $n=56$		Illness $n=32$	
	Number of residents	Use per person	Number of residents	Use per person
Diazepam	35	0.625	10	0.31
Anticonvulsants	12	0.21	4	0.13
Hexamine salts	24	0.43	5	0.16
Ammonium chloride	22	0.39	5	0.16
Baclofen	29	0.52	3	0.09
Prazosin	18	0.32	1	0.03
Phenxybenzamine	13	0.23	3	0.09

Table 5 Number of residents taking multiple medication from a therapeutic category ($n=88$)

Therapeutic category	Number of medications taken						Percent
	2	3	4	5	6	7	
Central Nervous System	18	12	11	3	2	3	55.7
Alimentary	25	11	3	3			47.7
Genitourinary	24	4					31.8
Musculoskeletal	9	3					13.6
Cardiovascular	7	1	1				10.2
Nutritional	6	1					7.9
Respiratory	8	3	1				13.6
Antiinfective	5	1					6.8
Hormonal	2						2.3
Haematinics	1						1.1
Skin	1						2.3

Table 6 Percentage of residents on multiple medication from a therapeutic category ($n = 88$)

Therapeutic category	Males	Females	Percentage	
			< 65	65 and over
CNS	51	65.5	50	71.4
Alimentary	45.7	51.7	37.7	71.4
Genitourinary	45.8	3.4	36.7	21.4
Musculoskeletal	11.9	17.2	8.3	25
Cardiovascular	11.9	6.9	6.7	17.9
Nutritional	10.2	3.4	5	10.7
Respiratory	17	6.9	13.3	14.3
Antiinfective	6.8	6.9	8.3	3.6
Hormonal	1.7	3.4	3.3	3.6
Haematinic	0	3.4	0	3.6
Skin	3.4	0	1.7	3.6

There were no significant trends between level of injury groups with regard to multiple medication usage.

Discussion

From the data it is clear that this predominantly young population consumed high levels of medication. Level of injury was the primary determinant of the individual items required by SCI persons. The overall number of items used, however, was more likely to be determined by age, as older persons in both the general and SCI populations use more medication than younger members. Gender was not a determinant of either the type or the level of medication use, however, common patterns were noted as most SCI persons were young males.

The patterns observed in this study were influenced by the residential nature of the specialist facility. This biased the population towards those with high levels of injury, those with low levels of injury who had multiple other pathology and others, who were unable to cope independently in the general community. Thus there were two broad groups; those with dedicated SCI problems due to high level injuries, and those with more diverse, but incapacitating problems. This contributed to the high level of both SCI specific, as well as the more diverse types of medications prescribed.

As the majority of injuries are received early in life, and as problems will not diminish, but in fact may increase, SCI medications will be taken for a life time. The number of items and the number of doses per day required for some medications (for example, four times daily for ammonium chloride), predisposes to compliance difficulties. This problem is effectively dealt with in this residential facility, however, for SCI persons living independently in the community, compliance may be difficult to achieve.

The patterns of medication usage observed are best interpreted when compared to other populations of medication users. It is difficult to select an appropriate population for comparison, but elderly populations have been chosen because the elderly are reported to

use higher numbers of medication than the general population. Such literature reports for both nursing home and community dwelling elderly populations quote 3.71 and 2.87 (25), 3.52 (prescription 2.23, OTC 1.31) (25), 4.3 (26), 3 (27) and 2.02 (prescription only)²⁴ medications per person. This spinal cord injured population averaged 2–3 times this level of medication.

Comparisons of the types of medications used by elderly *versus* SCI populations proved difficult, due to various research methodologies. Despite this, CNS medications comprised the most commonly prescribed group in a number of geriatric populations,^{25–28} as in the SCI population. The data from the geriatric populations did not allow evaluation of individual CNS item usage.

Alimentary medication use was also relatively common within geriatric populations, possibly also due to the inclusion of laxatives, as in the SCI population.^{25,27} The types of laxatives used may have varied as the SCI population made minimal use of bulk forming laxatives, which are the recommended choice for elderly patients.

Comparative use of genitourinary medication was difficult as diuretic use in the elderly is often high,^{24, 26–28} but diuretics were variously classified as cardiovascular medications or left as their own group by different researchers. The use of diuretics in the SCI population was low compared with that of hexamine salts and ammonium chloride which were among the 10 most commonly prescribed items for the SCI population, but not mentioned in geriatric data.^{24,27} While relative use of genitourinary medication was difficult to assess, it was apparent that the individual items in common use differed.

Musculoskeletal medication, in one form or another, is used with moderate frequency in geriatric populations, but with greater frequency in SCI populations. The individual items varied, with the elderly using mainly NSAIDs and analgesics, and those with SCI using mainly baclofen and diazepam. Older members of the SCI population also took more NSAIDs and less diazepam/baclofen than younger residents.

Cardiovascular medication featured prominently in both populations,^{24–28} with digoxin and diuretics listed among the 10 most commonly used items for geriatric populations. Cardiovascular medication for the SCI population consisted mainly of prazosin and phenoxybenzamine to aid in urinary voiding, while those items in common use for elderly populations were used minimally. In summary, the majority of medications used by both geriatric and SCI populations came from 3–5 main therapeutic categories and the most commonly used categories of medication were similar, although the individual items in high use differed substantially. In addition, items were often used differently in the SCI population compared with geriatric populations.

Spinal cord injured persons use an average of 2–3 times the number of medications as elderly patients. As elderly patients use 2–3 medications on average, this number may be expected to be added to the regimes of SCI persons as they age. Additionally, these are likely to be from similar therapeutic categories.

Elderly patients are considered to be at risk from drug misadventure due to multiple pathology, age related changes and polypharmacy. Spinal cord injured persons must therefore be considered at greater risk initially due to their level of medication use and injury related changes.

This study did not extend to analysing the appropriateness of each medication in individuals or the incidence of side effects that occurred, but focused on the level and pattern of medication use and how that was influenced by age, gender, level and mode of injury. Having established the above, it has become clear that this group warrants close attention to medication management, as they will be increasingly difficult to manage as medication use continues to rise. The level of medication usage may well be necessary, however, minimisation commensurate with good clinical care can only be advantageous in terms of personal well being and cost containment.

Conclusions

This study has demonstrated that SCI persons are managed on complex long term medical regimes. Evaluation of the literature regarding elderly populations suggests that the complexity will increase as they age.

Monitoring of the underlying complications of SCI and continued assessment of the effectiveness of the overall medication regime is the responsibility of health professionals. Persons with SCI represent both a challenge and an opportunity in terms of optimising complicated long term therapy for what is an increasing sector of the general community.

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