

Research article

Medication-related problems in individuals with spinal cord injury in a primary care-based clinic

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Objective: To determine the frequency of medical problems, reason for referral/primary complaint, products used, medication-related problems, and polypharmacy in patients with spinal cord injury (SCI) seen at an interprofessional primary care mobility clinic.

Design: Retrospective review of medical records of patients with SCI for patient visits between August 2012 and March 2013.

Methods: Data were abstracted from medical records of patients with SCI.

Results: Of 74 patients who presented to the clinic, 19 had an SCI. Mean age was 46.7 years and 74% were male. Most frequent medical problems were depression/anxiety (37%), osteoporosis/osteopenia (26%), hypertension (21%), dyslipidemia (21%), and osteoarthritis (21%). Most common presenting complaints were pain (23%) and bowel/bladder issues (13%). Most common medication-related problems were untreated conditions (41%), ineffective medications (21%), adverse drug reactions (18%), and under- and over-dosage (each 9%). Patients with SCI most frequently used products to treat pain (68%), constipation (42%), muscle spasm (42%), hypertension (42%), and depression (37%). When including natural health products, vitamins and minerals, polypharmacy was seen in 74% of patients with SCI (63% when limited to prescription and over-the-counter medications). For patients with SCI in whose care a pharmacist collaborated, a mean of 3.2 medication-related problems per patient were identified compared with 1 per patient when the pharmacist was not involved.

Conclusion: This study is the first to describe medication use, polypharmacy and medication-related problems in patients with SCI seen at an interprofessional primary care clinic. Use of high-risk medications, polypharmacy, and medication-related problems in patients with SCI suggest the need for collaborative interprofessional care that includes a pharmacist.

Keywords: Adverse drug reaction, Drug side effects, Pharmacists, Polypharmacy, Spinal cord injury

Introduction

Spinal cord injury (SCI) often is a life-altering event that can place a significant burden on individuals, their families and caregivers, and society. SCI may shorten life expectancy and has short- and long-term consequences on an individual's health, mobility, productivity, and socioeconomic status.¹ The annual incidence of SCI in the United States is 40 cases per million people.¹ The initial incidence of traumatic SCI in Canada, defined as individuals with traumatic SCIs at the injury scene, was estimated for the first time by Noonan and colleagues

at 53 per million people and the discharge incidence, defined as individuals with traumatic SCIs discharged into the community, to be 41 per million in 2010.² The discharge incidence of nontraumatic SCI was estimated at 68 per million, and the prevalence of SCI in Canada to be 85,556 people, of which 51% were classified as traumatic and 49% as nontraumatic.² In Ontario, Canada, the incidence of traumatic SCI has increased, from approximately 20 per million in 1997 to almost 50 per million in 2000.³

Patients with SCI face lifelong challenges and experience significant secondary health conditions, among them chronic pain, muscle spasms, bowel and bladder problems, osteoporosis, depression, cardiovascular disease,

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diabetes, infections, and fatigue.⁴ Many of these conditions consequently are managed with pharmacotherapy. A prospective study in Denmark that investigated medication use among 72 patients admitted with a spinal cord lesion found that medication consumption increased 3.29-fold relative to that before SCI.⁵ Similarly, a retrospective case-control analysis of claims datasets from 4,800 hospitals between 2007 and 2009 found that patients with SCI were prescribed significantly more medications than those who did not have SCI.⁶ Polypharmacy, defined as use of five or more concomitant prescribed medications, was twice as common among patients with SCI than in a control population (56% vs 27%). Within this group a small number of patients with SCI were examples of extreme polypharmacy, as they had been prescribed 34 to 39 concurrent medications. The study also revealed that of the patients with SCI who met the criteria for polypharmacy 92% were prescribed high-risk medications such as non-barbiturate sedative-hypnotics, anxiolytic agents, serotonergic system agents, analgesic-narcotics, anticonvulsants, skeletal muscle relaxants, and tricyclic antidepressants compared with 44% who were prescribed such medications in the control population.⁶ The chronicity of secondary health conditions, their comorbidity, the limited efficacy of pharmacotherapy along with the increased likelihood of polypharmacy expose patients with SCI to a multitude of drug-related problems.^{4,7-13}

Comprehensive healthcare in Canada starts with a patient's primary care provider, i.e. the family physician is the patient's first point of contact for assessment, diagnosis, and treatment as well the healthcare provider who coordinates care of community-dwelling patients. The number of patients with SCI in a given practice, however, tends to be low, such that a family physician may have only 1 or 2 patients with SCI under his or her care.¹⁴ This lack of exposure to patients with SCI along with inadequate experience and confidence to address the multiple health issues these patients face can combine to make treatment and care less than optimal.¹⁴

Although interest in describing pharmacotherapy in patients with SCI is increasing as is knowledge about optimal pharmacotherapy, research in this area is in its infancy, with few publications assessing the types of drugs being prescribed and the medication-related problems experienced by patients with SCI. Jensen and colleagues⁵ have documented an increase in medication intake by patients recently diagnosed with SCI in an acute care environment and Kitzman and colleagues⁶ have demonstrated significantly higher rates of polypharmacy, use of high-risk medications, and occurrence

of adverse drug events in patients with SCI on polypharmacy. However, neither study described the prevalence of pharmacotherapy, polypharmacy, or types of medication use among the SCI populations served by a primary care-based clinic. Furthermore, neither study addressed medication-related problems experienced in this population.

This study describes the prevalence of pharmacotherapy and medication-related problems in patients with SCI who presented at a primary care-based clinic that serves patients with mobility issues. The aim of this study is to describe (1) the demographics of the SCI patient population presenting to this primary care-based mobility clinic, (2) the prevalence and use of pharmacotherapy, and (3) the medication-related problems and prevalence of polypharmacy.

Methods

Setting

The study was conducted using data from electronic patient records in a primary care-based clinic. Located in Kitchener, Ontario, the Centre for Family Medicine (CFFM) Family Health Team is comprised of 18 family physician practices with a combined base of more than 28,000 patients. In 2010, the CFFM Family Health Team, in conjunction with the Ontario Neurotrauma Foundation, developed an interprofessional Mobility Clinic to address the needs of patients with physical disabilities, including those with SCI, and improve their access to quality primary care. The Mobility Clinic offers physical accessibility (e.g. high/low exam table, overhead lift, wheelchair scale), along with the expertise of its team members. The clinic was originally comprised of a family physician, chiropractor, occupational therapist, and nurse.^{15,16} In 2012, a pharmacist joined the Mobility Clinic. Patients with mobility concerns or impairments are referred to the Mobility Clinic by the other 17 family physicians in the Family Health Team, and since 2014 the clinic has received referrals outside the CFFM.^{15,16} A more detailed description of the Mobility Clinic and the innovations implemented to improve access and care of patients with physical disabilities, especially those with SCI, has been published previously.¹⁶

Study design

This research study retrospectively reviewed medical records of patients who presented to the CFFM Mobility Clinic from August 2012 to March 2013. Relevant data were abstracted from charts for all eligible patients. To be eligible for inclusion and analysis, individuals had to have a documented SCI.

The Office of Research Ethics at the University of Waterloo approved the study.

Data collection and analysis

Medical records were screened for eligibility. Variables of interest were abstracted from medical records of eligible patients for each patient visit at the clinic during the study period. An undergraduate pharmacy student, under one of the investigator's supervision, abstracted data then entered variables into a spreadsheet. These included demographic information, reason for referral to Mobility Clinic, primary complaint at clinic visit, past medical history, current medications, medication-related problems, responses to address medication-related problems, and pharmacist activities related to patient visit. Data abstracted from the chart detailed the assessment and plan for the patient's visit.

To ensure that record extraction was accurate and comprehensive, where possible missing data were obtained from other sections of the chart, such as those summarizing current medical problems and medications. The electronic records provide start and stop dates of medications, thus these data were used to identify all medications used by the patient at the time of visit. Descriptive statistics were used to describe the SCI population and variables of interest.

Medication-related problems

A medication-related problem was defined as "an undesirable event experienced by a patient that involves, or is suspected to involve, drug therapy, and interferes with achieving the desired goals of therapy and requires professional judgment to resolve."¹⁷ Under this definition, examples of medication-related problems that can arise are the following:

- untreated conditions, where a medical condition requires drug treatment or where preventive drug therapy is required to decrease the risk of developing a new condition, or where additional drug treatment is required for synergistic effects;
- minimally or ineffective drug therapy, where the drug is not effective for the condition, or where the condition is refractory to the drug, or the dosage form of the drug is inappropriate for the condition;
- inappropriate use by patient or non-compliance, where the patient does not understand the instructions on appropriate use of the drug, or cannot afford the drug, or where patient prefers not to take the drug or forgets to take the drug, or patient is physically unable to administer the drug;
- under-dosage, where the dose is too low to produce desired outcomes or the duration of treatment may have been too short;

- over-dosage, where the dose of the drug is too high or where duration of drug therapy has been too long;
- unnecessary drug therapy, where there is duplicate therapy or no indication or non-drug therapy is more appropriate; and
- adverse drug reactions, where the drug produces an undesirable reaction or patients have an increased risk due to risk factors, or patients have an allergic reaction.¹⁷

Polypharmacy in this study was defined as the use of five or more products by a patient. Products were defined as prescription medications, over-the-counter drugs, vitamins, minerals, and natural health products.

Results

Demographics

Of the 74 patients who presented at the Mobility Clinic during the study period, 19 had a documented SCI. The mean age of these patients with SCI was 46.7 years (range 18–89 years) and 74% were male. Of these patients with SCI, 11 (58%) used a wheelchair, 5 (26%) used a walker, a cane or two canes, and 1 (5%) used no aids for mobility. Mobility aid data were absent for 2 (11%) patients.

The 19 patients with SCI presented for 23 visits during the study period; 16 patients (84%) were seen once, 2 (11%) for 2 visits, and 1 (5%) for 3 visits. The most frequent medical problems noted in the patient records were depression/anxiety (37%), osteoporosis/osteopenia (26%), hypertension (21%), dyslipidemia (21%), osteoarthritis (21%), constipation (16%), peripheral vascular disease (16%), incontinence (16%), and hypothyroidism (16%). Less commonly noted medical problems were asthma, diabetes mellitus, gastroesophageal disease, myocardial infarction/heart failure, stroke/transient ischemic attack, and atrial fibrillation, among others (Table 1).

Reason for referral and primary complaint

The most common reason for referral or the SCI patient's presenting complaint was pain ($n = 7$, 23%), followed by bowel and bladder issues ($n = 4$, 13%), and erectile dysfunction ($n = 3$, 10%). Five patient visits (16%) were to complete a comprehensive physical exam (annual general assessment) during which a full medical history, physician exam, and systemic review are performed annually. Three patients were scheduled for consultation with an occupational therapist because of mobility and ambulation concerns or an assessment for return to work, and 2 were seen for medication-related issues. Patients also presented, though less frequently, with complaints of spasticity, weight gain,

Table 1 Medical problems noted in records of patients with SCI

Medical problem	N	%
Depression/anxiety	7	37
Osteoporosis/osteopenia	5	26
Hypertension	4	21
Dyslipidemia	4	21
Osteoarthritis	4	21
Constipation	3	16
Peripheral vascular disease	3	16
Hypothyroidism	3	16
Asthma	2	11
Diabetes	2	11
Gastroesophageal reflux disease	2	11
Incontinence (urinary/fecal)	3	16
Erectile dysfunction	1	5
Myocardial infarction/heart failure	2	11
Stroke/transient ischemic attack	2	11
Peripheral neuropathy	1	5
Atrial fibrillation	1	5
Degenerative disc disease	1	5
Sleep apnea	1	5
Cancer	1	5

penile rash, progressive weakness, and a pressure ulcer, as well as because of a motor vehicle accident (Table 2).

Medications and medication-related problems

The mean number of products used concurrently per SCI patient was 8 (range 2–27 per patient) and included prescription and over-the-counter medications, natural health products, and vitamins and minerals. The mean number of prescription and over-the-counter medications, including marijuana, per SCI patient was 7 (range 2–23 per patient).

Table 2 Reason for referral and primary complaint

Reason for visit	N*	%
Pain	7	22.6
Other	7	22.6
Spasticity	1	
Weight gain	1	
Penile rash	1	
Progressive weakness	1	
Motor vehicle accident	1	
Ependymoma	1	
Ischial wound	1	
Comprehensive physical examination	5	16.1
Bowel/bladder	4	12.9
Erectile dysfunction	3	9.7
Occupation therapist	3	9.7
Declining mobility	1	
Return to work	1	
Ambulation	1	
Medication	2	6.4
Pain	1	
Baclofen pump	1	
Total	22	100

*Some visits occurred for more than one reason.

Patients with SCI most frequently used products for treatment of pain ($n = 13$, 68%), constipation ($n = 8$, 42%), muscle spasm ($n = 8$, 42%), hypertension ($n = 8$, 42%), and depression ($n = 7$, 37%). Medications to treat endocrine conditions such as thyroid disorders, osteoporosis, and diabetes were used by 32% of patients ($n = 6$) as were drugs for gastro-intestinal protection (proton-pump inhibitors and histamine receptor antagonists). Urinary anticholinergics were prescribed for 26% ($n = 5$), while agents for sexual dysfunction were prescribed for 21% ($n = 4$). Twelve patients (63%) used natural health products, vitamins and minerals, the majority of which were vitamin D and calcium supplements. Benzodiazepines were also prescribed for 21% ($n = 4$) of patients (see Table 3 for number and percentage of patients taking medications, vitamins and minerals and natural health products).

A total of 34 (mean 1.8, range 0–6) medication-related problems were noted among the 19 patients with SCI. Most frequently identified was untreated condition ($n = 14$, 41%), followed by minimum/not effective medications ($n = 7$, 21%). Adverse drug reactions were noted in 18% of patients ($n = 6$), under- and over-dosage were noted in 9% each ($n = 3$), and non-compliance in 6% ($n = 2$). Responses to these medication-related problems were as follows: provided patient education 14 times (41%), initiated medication 5 times (15%), increased dosage 5 times (15%), decreased dosage 3 times (9%), continued medications 2 times (6%), and changed schedule of medication administration 2 times (6%). The following responses were each noted once in the medical records: discontinuing medication, appropriate therapeutic monitoring, and strategies to improve compliance (each 3%).

Use of 5 or more products, including all prescription, over-the-counter, natural health products, and vitamins and minerals was noted in 74% of the patients with SCI. When limited to prescription and over-the-counter medications, polypharmacy was seen in 63% of patients with SCI.

Pharmacist activities

Of the 19 patients with SCI, the team pharmacist documented a medication-related problem and plan for 5 patients (26%). Of the 34 medication-related problems, 16 were noted in collaboration with a pharmacist, and 18 were documented when the pharmacist was not involved in patient care. For those patients in whose care the pharmacist collaborated, a mean of 3.2 medication-related problems per patient were noted compared with 1 per patient when the pharmacist was not involved. The pharmacist more frequently addressed

Table 3 Medications, vitamins, minerals and natural health products taken by patients with SCI

Medication class and subcategory	Total # (% of total # of products)	# of patients with SCI taking medication class (%)	Range of products taken/patient
Pain	28 (18)	13 (68)	0–5
Analgesics (i.e. acetaminophen)	2	2 (11)	
Nonsteroidal anti-inflammatory analgesics	6	6 (32)	
Narcotics or combination narcotics	9	6 (32)	
Marijuana or marijuana-like products	4	3 (16)	
Antiepileptic drugs	7	7 (37)	
Natural health products + vitamins + minerals	25 (16)	12 (63)	0–4
Natural health products	2	2 (11)	
Vitamin D	8	8 (42)	
Vitamin, other	6	5 (26)	
Calcium	7	7 (37)	
Ferrous gluconate	1	1 (5)	
Magnesium citrate	1	1 (5)	
Constipation	18 (12)	8 (42)	0–5
Stool softener	6	6 (32)	
Stimulant	7	6 (32)	
Osmotic	4	3 (16)	
Gastrointestinal motility	1	1 (5)	
Skeletal muscle relaxant	11 (7)	8 (42)	0–3
Tizanidine	1	1 (5)	
Baclofen/Dantrolene	10	8 (42)	
Antihypertensives	10 (6)	8 (42)	0–2
Angiotensin converting enzyme inhibitor/Angiotensin receptor blocker	3	3 (16)	
Beta blocker	1	1 (5)	
Diuretic	5	5 (26)	
Clonidine	1	1 (5)	
Endocrinological	9 (6)	6 (32)	0–3
Thyroid	3	3 (16)	
Bisphosphonate	1	1 (5)	
Oral anti-diabetic	5	2 (11)	
Gastro-intestinal	8 (6)	6 (32)	0–2
Proton pump inhibitor	5	5 (26)	
Histamine 2 receptor antagonist	1	1 (5)	
Over the counter	2	2 (11)	
Antidepressant	7 (5)	7 (37)	0–1
Selective serotonin receptor inhibitor	2	2 (11)	
Serotonin-norepinephrine receptor inhibitor	3	3 (16)	
Tricyclic antidepressant	2	2 (11)	
Respiratory	7 (5)	5 (26)	0–2
Inhaled corticosteroids	4	4 (21)	
Inhaled beta agonist	3	3 (16)	
Urinary anticholinergic	5 (3)	5 (26)	0–1
Sexual dysfunction	4 (3)	4 (21)	0–1
Phosphodiesterase 5 inhibitor	4	4 (21)	
Cholesterol	3 (2)	2 (11)	0–2
3-hydroxy-3-methylglutaryl-coenzyme reductase inhibitors	1	1 (5)	
Fibric acid	1	1 (5)	
Cholesterol absorption inhibitor (ezetimibe)	1	1 (5)	
Other	17 (11)	8 (42)	0–4
Anti-infective	2	2 (11)	
Antipsychotic	2	1 (5)	
Antithrombotic	2	2 (11)	
Anticholinergic	1	1 (5)	
Benzodiazepines	5	4 (21)	
Miscellaneous	5	5 (26)	

medication-related problems stemming from adverse drug reactions (67% vs 33%) and under-dosage (100% vs 0%), while untreated conditions were addressed more frequently when the pharmacist was not involved

in patient care (72% vs 28%). Other medication-related problems were addressed fairly equally whether or not the pharmacist was participating in the care of patients (Table 4).

Table 4 Types of medication-related problems

Type of MRP	Pharmacist note <i>N</i>	No pharmacist note <i>N</i>	Total <i>N</i>	% of total
Untreated condition	4	10	14	41.2
Adverse drug reaction	4	2	6	17.6
Minimally effective/not effective	3	4	7	20.6
Under-dosage	3	0	3	8.8
Patient noncompliance	1	1	2	5.9
Over-dosage	1	1	2	5.9
Total	16	18	34	100
Mean MRP/patient	3.2 (range 3–6)	1.3 (range 0–4)	1.8 (range 0–6)	

Discussion

To our knowledge, this study is the first to demonstrate the types of pharmacotherapy, the prevalence of polypharmacy, types of medication-related problems, and pharmacist activities in an interprofessional primary care clinic serving patients with SCI. The patients with SCI seen in this team-based practice varied in age, and presented with complex chronic medical conditions.

Patients with SCI have both a higher proportion of and an accelerated risk of developing chronic diseases and complications, including cardiovascular disease, osteoporosis, mood disorders, persistent pain syndromes, and cognitive impairments. Comorbidities are common and often require polypharmacy, which can make treatment more complex and increase the risk of medication-related problems including adverse drug reactions.

Polypharmacy in patients with SCI is common, as was observed in our study as well as in a prospective study conducted among 72 patients with spinal cord lesion⁵ and a retrospective case-control analysis of 13,160 individuals with SCI.⁶ However, in comparison to the retrospective case-control study, we found a higher rate of polypharmacy (74%) when all products were considered, as well as when polypharmacy was limited to prescribed and over-the-counter medications (63% vs 56%). This difference may be attributable to the definitions of polypharmacy adopted by the study authors. Our definition included non-prescribed, non-over-the-counter products, including natural health products, calcium-containing products, and vitamins, while the previous retrospective analysis⁶ limited polypharmacy to the use of 5 or more *prescribed* medications. Even though natural health products and over-the-counter medications are considered safe by many patients, our definition of polypharmacy included these products because they can cause adverse events. Indeed, one adverse drug reaction noted in our study stemmed from overuse of calcium-containing products. Furthermore, the previous retrospective case-control study found that patients with SCI prescribed 5 or

more medications were 3.7 times more likely to have a clinically significant adverse drug event than patients with SCI who are prescribed fewer than 5 medications.⁶ Of the 16% of patients with SCI in our study who reported adverse effects, 66% were taking 5 or more prescribed and over-the-counter medications, a finding that reinforces the importance of obtaining a comprehensive list of products taken.

Use of high-risk medications, such as skeletal muscle relaxants, anticonvulsants, antidepressants and benzodiazepines, was also prevalent in this group of patients with SCI. At least one medication from one of these drug classes was prescribed for 15 of the 19 patients in our study. Drugs within these classes increase the risk of falls, and even though those with SCI may not be ambulatory, falls and limitations in mobility can still occur.^{10,13} In a population of more than 7000 male veterans with a history of traumatic SCI, opioid use was associated with an increase in risk of lower extremity fractures.¹³ Furthermore, daily use of medications for pain and spasticity may limit the SCI patient's ability to ambulate or mobilize and cause fatigue.^{11,12}

Pharmacist participation in interprofessional teams has been demonstrated to improve health outcomes in patients with other medical conditions.¹⁸ Pharmacist contribution to the care of patients with SCI has not been reported previously. A significant proportion of patients with SCI in our study were taking multiple and high-risk medications, and 63% had at least 1 medication-related problem. Although the pharmacist on the team noted recommendations on drug-related problems in only 26% of the patients seen at the clinic during the study period, this individual reported a greater number of medication-related problems per patient compared with those the individual had not seen (3.2 vs 1). This may indicate not only a greater focus on medication-related problems by pharmacists, but suggests that a pharmacist's clinic time may be best allocated to assess and treat patients who required a medication review based on the number of medications taken or those presenting with an identified medication-related problem.

Study limitations

Although retrospective chart reviews have the advantage of examining medication use in a select group of patients expeditiously and economically, this method of data collection has limitations, including those that stem from variability in the quality and comprehensiveness of documentation by different health professionals. Our retrospective review of medical records did not permit a comprehensive assessment of the number and types of natural health products and over-the-counter products taken by all patients with SCI. Although this information was elicited from patients during clinic visits where a pharmacist was available, not all patients provided this information during clinic visits when a pharmacist was not present, or, if provided by patients possibly not as comprehensively had a pharmacist been present. Furthermore, patients may not provide their family physicians with a complete list of medications, especially those prescribed by specialists. Our report of the use of natural health and over-the-counter products by 12 patients with SCI likely under-represents actual use, the consequence of which is the inability to accurately and comprehensively identify all medication-related problems patients with SCI face. The 34 medication-related problems identified in our patients with SCI likely also under-represents the true figure. Many natural health products interact with prescription drugs and can cause adverse drug reactions, which could be misidentified as a symptom of a medical condition. Similarly, we were not able to assess compliance with all the medication regimens. Nonadherence was determined to be a medication-related problem in 9% of this patient population; however, nonadherence may not have been assessed at each clinic visit or, if assessed, may not have been documented in the medical record. Medication-related problems considered minor may have been conveyed orally to the clinic team by the pharmacist but without documentation in the chart. A prospective study would allow more accurate and comprehensive documentation of all products taken, thus further clarify the types of medication-related problems patients with SCI encounter.

The small sample size in our study limits generalizability to a larger SCI population as well as the ability to conduct statistical analysis. However, our results indicated that polypharmacy and the use of high-risk medications is prevalent in this population similar to the larger SCI patient populations studied by Kitzman and colleagues.⁶

Conclusion

The SCI population presenting to primary care is frequently young, with a wide range in age, with multiple

medical problems and complex pharmacotherapy. Because of multiple comorbidities associated with SCI, treatment with pharmaceuticals and nonpharmaceuticals will generally be higher in this population of patients than in those without SCI. Our study provides further evidence that polypharmacy, including use of natural health products, vitamins and minerals, is prevalent in patients with SCI. It also demonstrates the need for vigilance with respect to polypharmacy that includes the use of natural health products, vitamins and minerals, the types of medications prescribed, and the combination of pharmacotherapeutic treatment regimens in patients with SCI. Collaborative interprofessional practice that includes a pharmacist can be instrumental in detecting and addressing polypharmacy, use of natural health products, vitamins and minerals, use of high-risk medications, and medication-related problems.

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Conflicts of interest All authors state formally that no conflict of interest exists.

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