

Quality of Life and Bladder Management post Spinal Cord Injury: A Systematic Review

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Abstract To explore the relationship between neurogenic bladder management techniques and quality of life (QoL) among individuals with spinal cord injury (SCI). A key terms literature search was conducted in multiple electronic databases (i.e., MEDLINE, CINAHL, EMBASE, and PsycINFO). Studies published up to and including May 2013 were reviewed and evaluated based on the following criteria: (1) full-length journal article published in the English language; (ii) human subjects ≥ 18 years; (iii) ≥ 50 % of subjects had a SCI; (iv) results on QoL, as it related to bladder management method, were reported for at least three subjects. A total of 422 articles were extracted and upon review of titles and abstracts, 7 studies met the inclusion criteria. There were two level 2 cohort studies and five level 5 observational studies. Sample sizes ranged from 37 to 282 with an average of 117.1 individuals per study. All participants were at least six months post injury. Bladder management methods used included intermittent (patient/attendant), indwelling (suprapubic/transurethral), and condom catheterization, micturition assistive maneuvers, and electrical stimulation. Normal voiders scored better in all QoL measure domains compared to other management methods. Those using attendant intermittent and indwelling catheterization scored the poorest on the domains Personal Relationships, Emotions, and Mental Health. There is insufficient evidence to provide a definite conclusion as to the relationship between bladder management

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methods and QoL post SCI. However, individuals relying on others to aid in voiding may experience lower QoL compared to those who are independent.

Keywords Spinal Cord Injury · Quality of Life · Bladder · Urology

Introduction

Annually, over 10,000 individuals are diagnosed with a spinal cord injury (SCI) in the United States (Fonte 2008; Sahai et al. 2011). Injury or disease to the central nervous system may result in neurogenic bladder dysfunction that often causes urinary retention and incontinence (Al-Shukri 2012). Urologic complications arising from neurogenic bladder are often a cause of subsequent morbidity (Fonte 2008).

The effects of bladder dysfunction vary among individuals; bladder dysfunction may be minimal to significant such that individuals have to depend on caregivers to void effectively (Hicken et al. 2001). In general, management options for neurogenic bladder after a SCI include facilitating bladder filling or urine storage, and facilitating bladder emptying. Bladder emptying techniques should not only minimize incontinence and prevent urine from being retained, but they should also sustain long-term renal function and integrity. There are currently several techniques available to use in the SCI population from more conservative (e.g., intermittent catheterization, pharmacological agents) to more invasive (e.g., indwelling catheterization, electrical stimulation, surgery). Catheterization is a common management technique, and includes the use of intermittent catheters and indwelling catheters. However, these devices place individuals at significant risks for urinary tract infections, bladder calculi, catheter blockage, urine bypass, squamous cell carcinoma, and bladder neck trauma if urethral catheters are used over the long-term (Hunter et al. 2012; Singh et al. 2011). Optimal treatment for neurogenic bladder post SCI is likely accomplished using an individualized approach which considers multiple factors.

Studies have shown that among individuals with SCI, perceived quality of life (QoL) may be impacted by bladder dysfunction (Westgren and Levi 1998; Noonan et al. 2008). Relationships with family, friends, and intimate partners may change as a result of experiencing urinary complications such as incontinence or urinary tract infections. Individuals may feel embarrassed which may lead them to avoid activities that were once enjoyed. Weld and Dmochowski (2000) found that the choice of bladder management method may negatively affect an individual with SCI physically, psychologically and socially. Thus, choosing an appropriate bladder management technique is important to their comfort and QoL (Ku 2006). At this time, there have been no systematic reviews which synthesize the existing literature on bladder management and QoL among those with a SCI. Having a better understanding of this relationship could allow health care professionals to better educate and promote the most medically effective, yet personally and socially accommodating, bladder management techniques. Thus, the purpose of this systematic review was to explore the relationship between neurogenic bladder management techniques and QoL among individuals with a SCI.

Methods

Literature Search Strategy

The research objectives and inclusion criteria were established before commencing the literature search. A systematic search of all relevant literature published up to and including May 2013 was conducted using multiple databases (e.g., MEDLINE, CINAHL, EMBASE, PsycINFO). Key words included: spinal cord injuries, tetraplegia, paraplegia, neurogenic, bladder, urology, and QoL. Search terms were altered for each database, as necessary. Retrieved references were manually scanned for relevant citations which may have been missed during the electronic search.

Study Selection

Full-length journal articles were reviewed and selected for analysis by two independent authors if: (i) it was published in the English language; (ii) subjects were human and ≥ 18 years old; (iii) ≥ 50 % of the subjects had a SCI; (iv) results were reported for at least three subjects; and (v) subjects rated their QoL using an outcome measure tool as it related to their neurogenic bladder management method. The bladder technique could not have changed during the study period. Furthermore, studies must have included sufficient reporting detail to enable data synthesis such that results on QoL were stratified by the bladder management method. Scoping and systematic reviews, along with studies from the 'grey literature,' were excluded from analysis.

Study Appraisal and Data Synthesis

Two independent reviewers extracted data on subject and study characteristics, study design, QoL outcome tool, and outcomes. Data was grouped and summarized in tables. The strength of the evidence for each intervention was rated using a modified Sackett scale. The original Sackett scale had ten levels of evidence but was simplified to produce just five levels. Randomized controlled trials with a Physiotherapy Evidence Database score ≥ 6 were rated as Level 1 evidence while studies with scores < 6 were rated as Level 2; prospective controlled trials and cohort trials were also rated as Level 2 evidence. Level 3 evidence included case control studies, while Level 4 evidence included pre-post, post-test, and case series studies. Lastly, case reports, clinical consensus and observational studies were considered Level 5 evidence.

Results

Study Selection

The study selection process is depicted in Fig. 1. A total of seven studies met inclusion criteria, with six studies (Oh et al. 2005; Bothig and Burgdorfer 2012; Sanchez et al. 2010; Liu et al. 2010; Luo et al. 2012; Akkoc et al. 2013) examining conservative bladder emptying techniques and one study (Vastenholt et al. 2003) examining the use of electrical stimulation. Evaluation of the data led to the conclusion that a meta-

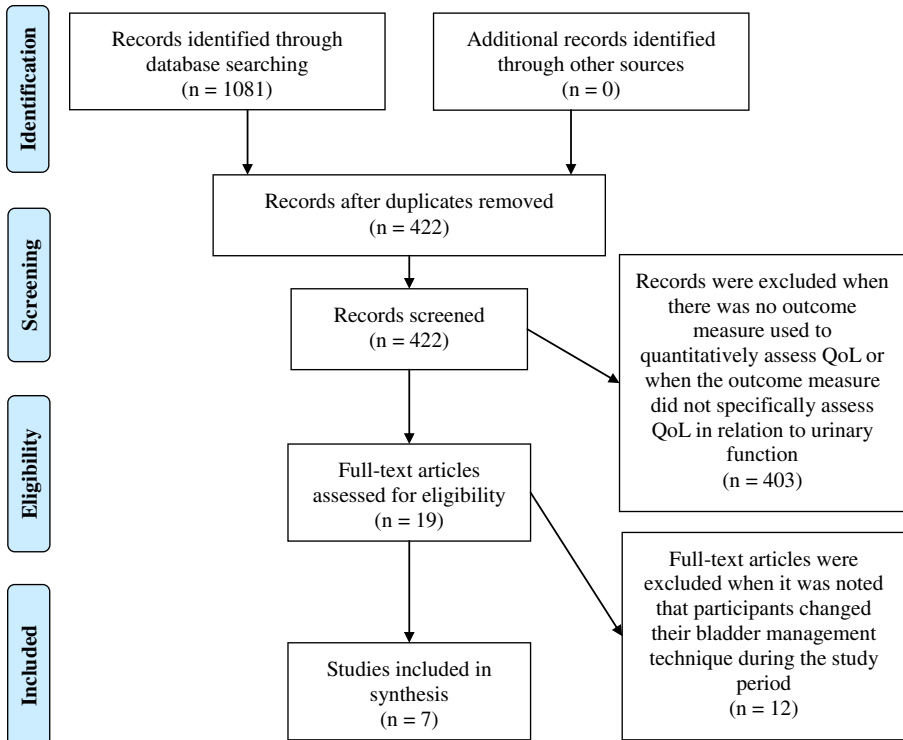


Fig. 1 Study selection process

analysis would be inappropriate due to the heterogeneity of the studies, inconsistency in the use of outcome measures, low methodological quality and insufficient data reported. There were no randomized controlled trials that met inclusion. Two studies (Oh et al. 2005; Vastenholt et al. 2003) were rated as Level 2 evidence and had cohort research designs. The remaining five studies (Bothig and Burgdorfer 2012; Sanchez et al. 2010; Liu et al. 2010; Luo et al. 2012; Akkoc et al. 2013) were rated as Level 5 evidence and had cross-sectional, observational research designs.

Study Characteristics

Patient characteristic data and QoL outcome data for each study is summarized in Table 1. Sample sizes for each of the seven studies ranged from 37 to 282 with an average of 117.1 subjects per study. The level of injury was not reported in three studies (Sanchez et al. 2010; Liu et al. 2010; Vastenholt et al. 2003); the remaining studies included patients with cervical, thoracic and/or lumbar level injuries. Five studies (Bothig and Burgdorfer 2012; Sanchez et al. 2010; Liu et al. 2010; Luo et al. 2012; Akkoc et al. 2013) reported the severity of their subjects' injuries using the American Spinal Injury Association Impairment Scale (AIS) ranging from A (complete loss of motor and sensory function) to E (normal motor and sensory function) whereas two studies simply reported the number of subjects who were paraplegic and tetraplegic (Oh et al. 2005; Vastenholt et al. 2003). Five studies (Oh et al. 2005; Bothig and Burgdorfer

Table 1 (continued)

Study Country Study Design Evidence	^a Age Time Post-Injury ^b Level of Injury ^c ASIA Scores (A-E)	^d Bladder Management Groups	Final Sample Size	^e Outcome Measure Construct(s)	^f Kruskal-Wallis	^g T-tests
	A-59%, Para-63%	male:female	70:21	RL PL SL PR EM S/E SS	+	+ UCA vs. ICP/IUC
Vastenholz et al. 2003 Netherlands Cohort Level 2	43 (23-63) 73 mo (46-498) Not Reported Para-62.2%, Tetra-37.8%	SARS non-SARS SCI controls	37 400	Qualiveen Questionnaire Limitations Constraints Fears Feelings		++ ++ ++ -
Luo et al. 2012 China Observational Level 5	21-40: 34% 41-60: 45% >60: 12% ‡2 yr C-8.3%, T-53.9% L-34.5%, N-3.3% A-22.8%, B-10.0% C-8.9%, D-41.1% E-17.2%	NV MAM UCA ICP/ICA ISC ITC	62 65 24 11 7 11	World Health Organization Quality of Life – BREF Physical Psychological Social Environment	+	++ ++ + -
		Total male:female	37 32:5			
		Total male:female	180 98:82			

Table 1 (continued)

Study Country Study Design Evidence	^a Age Time Post-Injury Level of Injury ^c ASIA Scores (A-E)	^d Bladder Management Groups	Final Sample Size	^e Outcome Measure Construct(s)	^f Kruskal-Wallis	^g T-tests
Bothig et al. 2012	45 (17-78)	ISC	32	International Consultation on Incontinence		
Germany	*8 yr (2-26)	ICA	11	Total Score		
Observational Level 5	C-100% A-82.1%,B-7.1%, C-10.8%	Total male:female	56 40:16			

Note:

[†]SCI patient data only; [‡]All patients exactly; *Median

^a Age is reported in years;

^b C = cervical; N = cord contusion; L = lumbar; T = thoracic;

^c ASIA = American Spinal Injury Association; mo = months; para = paraplegic; tetra = tetraplegic; yr = years;

^d NV = normal voiding; MAM = micturition with assistive maneuvers; ICA = intermittent catheterization by attendant; ICP = intermittent catheterization by patient; ISC = indwelling suprapubic catheterization; ITC = indwelling transurethral catheterization; IUC = indwelling unspecified catheterization; UCA = urine collecting apparatus; R = all remaining groups; SARS = sacral anterior root stimulation;

^e *Kings Health Questionnaire*: GH = general health perception; II = incontinence impact; RL = role limitations; SL = physical limitations; PL = physical limitations; PR = personal relationships; EM = emotions; S/E = sleep/energy; SS = symptom severity;

Shorti Form-36: PF = physical functioning; RP = role-physical; BP = bodily pain; GH = general health; RE = role-emotional functioning; VT = vitality; MH = mental health; SF = social functioning;

^f Kruskal-Wallis: ++ Significant difference in outcome between all groups ($p < 0.0001$); + Significant difference in outcome between all groups ($p < 0.05$); - No significant difference in outcome between all groups ($p > 0.05$);

^g T-Tests: The group with the better score (indicating good QoL) is listed first; ++ Significant difference in outcome between the two groups ($p < 0.0001$); + Significant difference in outcome between the two groups ($p < 0.05$); - No significant difference in outcome between the two groups ($p > 0.05$).

2012; Liu et al. 2010; Luo et al. 2012; Vastenholt et al. 2003) included patients that were ≥ 12 months post injury. One study (Akkoc et al. 2013) included patients who were ≥ 6 months post injury and the remaining study (Sanchez et al. 2010) did not specify a minimum time since injury. However, the mean time since injury for the latter two studies exceeded 4 years; thus, all subjects included in this review were considered to be in the chronic phase of SCI.

Outcome Measures

Five primary outcome measures were used to evaluate QoL: Short Form-36 (SF-36; Ware and Sherbourne 1992), Kings Health Questionnaire (KHQ; Kelleher et al. 1997), World Health Organization QoL - abbreviated version (WHOQOL-BREF; WHOQOL Group 1998), Qualiveen Questionnaire (QQ; Costa et al. 2001), and the International Consultation on Incontinence Questionnaire - Short Form (ICIQ-SF; Avery et al. 2004). A comparison of these outcome measures is shown in Table 2. Both the QQ and ICIQ-SF are urinary disorder-specific outcome measures, whereas the SF-36, KHQ, and WHOQOL-BREF are general health-related QoL measures.

QoL

The SF-36 was used to evaluate QoL among individuals with SCI experiencing neurogenic bladder in two studies (Oh et al. 2005; Liu et al. 2010). Oh et al. (2005) compared QoL scores of individuals with SCI using clean intermittent catheterization to individuals without a SCI in the general population; the groups were frequency matched for age and gender. Compared to the non-SCI controls, the authors reported significantly poorer QoL scores in every SF-36 domain ($P < 0.03$) except for the domain *Vitality* among females ($P = 0.064$) and younger individuals ($P = 0.146$).

Liu et al. (2010) measured QoL among individuals with SCI using micturition-assisted maneuvers (MAM), intermittent catheterization by an attendant or patient (ICA/ICP), indwelling catheterization suprapubically (ISC) or transurethrally (ITC), and normal voiders. The authors found that there was no difference between groups in QoL scores for every SF-36 domain except *Physical Functioning* ($P = 0.013$) and *Mental Health* ($P = 0.000$) where normal voiders scored higher than all other groups ($P < 0.05$). Additionally, individuals using ICA, ISC, and ITC had significantly worse scores than those using ICP or MAM on these same domains ($P < 0.05$). In addition to the SF-36, Liu et al. (2010) examined QoL using the KHQ. There were significant differences between groups in three domains: *Physical Limitations* ($P = 0.046$), *Personal Relationships* ($P = 0.021$), and *Emotions* ($P = 0.005$), to which individuals who could void normally scored better than the remaining groups ($P < 0.05$). In specifically examining the *Personal Relationships* and *Emotions* domains, individuals using ICA, ISC, and ITC scored significantly worse than MAM and ICP ($P < 0.05$).

Akkoc et al. (2013) also assessed QoL using the KHQ and found that compared to normal voiders, individuals using ICA had significantly worse scores in every domain ($P < 0.004$) except *General Health*, *Personal Relationships* and *Sleep/Energy*. Furthermore, those with ICA had worst scores than ITC ($P = 0.034$) in *Symptom Severity*. Individuals using ICP scored worse on *Incontinence Impact* ($P = 0.004$), *Physical Limitations* ($P = 0.005$), and *Symptom Severity* ($P = 0.001$) compared to normal

Table 2 Comparison of outcome measures used to assess quality of life by studies included for review

Outcome measure	Short form-36	Kings Health Questionnaire	World health organization QoL-BREF	Qualiveen questionnaire	International consultation on incontinence questionnaire short form
Author(s)	C. D. Sherbourne and J. E. Ware	C.J. Kelleher, L.D. Cardozo, V. Khullar and S. Salvatore	World Health Organization QoL group	P. Costa	K. Avery, I. Donovan, T.J. Peters, C. Shaw, M. Gotoh, and P. Abrams
Main topic	Health-related QoL (incl. health status)	Health-related QoL	Health-related QoL	Health-related QoL (incl. health stats)	Incontinence and QoL
Objectives	To measure generic health concepts relevant across age, disease, and treatment groups	To assess the impact of lower urinary tract symptoms including urinary incontinence on health-related QoL	To assess individuals' perceptions on the quality of their life.	To assess the QoL of SCI patients with urinary disorders	To assess the impact of symptoms of incontinence on QoL and outcome of treatment.
Domains	<ul style="list-style-type: none"> • General health • Physical functioning • Role physical • Bodily pain • Vitality • Social functioning • Mental health • Role emotional • Reported health transition 	<ul style="list-style-type: none"> • General health perception • Physical limitations • Sleep/Energy • Role limitations • Emotions • Social limitations • Personal relationships • Incontinence Impact • Symptom severity 	<ul style="list-style-type: none"> • Physical • Psychological • Social relationships • Environment 	<ul style="list-style-type: none"> • Limitations • Constraints • Fears • Feelings 	<ul style="list-style-type: none"> • Frequency of urinary incontinence • Amount of leakage • Overall impact of urinary incontinence • Self-diagnostic item
Population	Adolescent/Adults	Adults	Adults	Adults	Adults
Time recall	The last 4 weeks	At present	The last 2 weeks	At present	At present
No. items	36 questions	21 questions	26 questions	40 items	4 items
Complete time	5–10 min	5–20 min	5–20 min	Less than 30 min	Less than 5 min
Administration mode	Self-administered	Self-administered	Self-administered	Self-administered	Self-Administered

Table 2 (continued)

Outcome measure	Short form-36	Kings Health Questionnaire	World health organization QoL-BREF	Qualiveen questionnaire	International consultation on incontinence questionnaire short form
Computer-administered	Interviewer-administered	Interview-administered	Interview-administered	Interview-administered	Interview-administered
No. translations	Telephone-administered	43	8	6	30

QoL quality of life, *SCI* spinal cord injury

voiders ($P=0.004$; $P=0.005$; $P=0.001$, respectively). Finally, individuals using MAM and ITC scored worse on *Social Limitations* than normal voiders ($P=0.00$ and $P=0.014$, respectively). Sanchez et al. (2010) found that only one domain on the KHQ, *Role Limitations*, was significantly different among their bladder management groups ($P=0.025$), where individuals using a urine collecting device (i.e., condom catheters) scored better than those using ICP and indwelling catheterization ($P<0.05$).

Conservative bladder techniques were also assessed using the WHOQOL-BREF and ICIQ-SF. Luo et al. (2012) found that there were significant differences among groups on the domains *physical* ($P=0.012$), *psychological* ($P=0.001$), and *social* ($P=0.023$), but not *environmental* ($P=0.07$). Those who could void normally scored the best, followed closely by those using MAM. However, UCA, IC, and ISC/ITC groups consistently scored the lowest on these domains; no statistical value was provided. Bothig and Burgdorfer (2012) did not find any difference in ICIQ-SF scores between their ICA and ISC groups.

Finally, one study (Vastenholt et al. 2003) examined patients who underwent a sacral anterior root electrical stimulator implantation for neurogenic bladder. After patients completed the QQ, the results were compared to data on 400 SCI patients provided in the manual of the QQ (reference group). The stimulation group reported better QoL scores compared to the reference group for the domains *Limitations* ($P<0.0001$), *Constraints* ($P<0.0001$), and *Fears* ($P<0.0001$), but not *Feelings* ($P=0.813$).

Discussion

At this time there is no “gold standard” for neurogenic bladder management after a SCI. Rather, patients should choose the methods and devices which fit their lifestyle and promote optimal QoL. Overall, the results of this systematic review have found that, regardless of the bladder management method, individuals with an SCI who could void normally had the highest QoL ratings. Conversely, individuals using intermittent (attendant) or indwelling (transurethral or suprapubically) catheterization had the poorest scores in the majority of the QoL domains assessed. Those using MAM and ICP had better scores than the former groups in the majority of domains including *Personal Relationships*, *Emotions*, and *Mental Health*. Additionally, compared to ICA, those using ICP had better *Physical Limitations* scores and those using ITC had better *Symptom Severity* scores. The use of urine collecting devices had a beneficial effect on QoL, with those using the device reporting better scores in *Role Limitations*.

Clean ICA/ICP is typically the first technique used for neurogenic bladder after a SCI and is favoured over ITC/ISC as it results in significantly fewer complications (Hung et al. 2007; Bennett et al. 2005). According to the Consortium for Spinal Cord Medicine clinical practice guidelines (2006), ICA/ICP should be considered by patients with sufficient manual dexterity or those with a willing caregiver. Although ICA/ICP has many benefits including low infection rates, some individuals may shift to an alternate treatment over time because of frequent incontinent episodes, the loss of a suitable caregiver, or the difficulty in execution related to a decline in manual dexterity (Wyndaele 2002). More invasive bladder management methods such as ISC/ITC have high complication rates which frequently results in individuals enduring urinary tract infections, bladder stones, and kidney stones (Reitz et al. 2007). The risk and

prevalence of complications associated with intermittent and indwelling catheterization likely contributes to a lower QoL compared to those who can spontaneously void.

To promote the best technique, both ICA/ICP and ISC/ITC involves sterilization of equipment, sufficient lubrication, and adequate space (Katsumi et al. 2010). An individual needing assistance with catheterization may not be able to accomplish this technique optimally without relocating to an appropriate location. Furthermore, it may be impractical outside of the hospital or home setting and does not cater to individuals that may have an active lifestyle or that travel frequently. Leaving or avoiding social and community activities to accomplish urination may impact an individual's psychological health as it can lead to feelings of social isolation. As the studies in this review demonstrated, individuals using ICA, and those using ISC/ITC, scored poorly on psychological and social domains of the QoL measures. It has been previously shown that locus of control has an important impact on an individual's QoL (Grigg et al. 2010). Hence, relying on others to aid in voiding could contribute to a lower QoL compared to those who are independent. To improve QoL outcomes, a more holistic management approach involving the mental status of the individual and their caregiver is integral. Future studies should examine the effect of an individual's perceived locus of control and caregiver burden on an individual's bladder management QoL.

Although this systematic review has summarized the current evidence, definitive conclusions on the intricate relationship between bladder management and QoL cannot be made at this time given the significant limitations of the studies included. Fundamentally, the articles used in this review had differing research designs with comparisons of QoL across varying bladder management groups. Six of the seven studies specifically assessed individuals with SCI. However, one study by Oh et al. (2005) compared a cohort of individuals with SCI using assistive methods to non-SCI controls who could spontaneously void. The authors did not include a group with SCI that could also void spontaneously. Questions relating to bladder function and QoL specifically among those with SCI were not addressed given that low QoL could have been related to other health conditions resulting from the SCI. Among the studies that examined only individuals with SCI, at times the bladder management groups were blended. For example, Vastenholt et al. (2003) compared QoL data from individuals receiving Brindley stimulation to those from a reference group. The authors grouped the reference individuals together, despite that they were using different methods of bladder management (ICS 41 % and MAM 28 %). Thus, the exact relationship among bladder management methods remained inconclusive. Since the authors did not have access the crude data from the reference group, other confounding variables could not be examined.

The lack of analyses on confounding variables (e.g., sex, age, injury severity) among all of the studies was a significant limitation. It is possible that the relationship between QoL and bladder management is simply an association with injury severity. That is, QoL may not be the result of the bladder management method but rather is associated with more severe SCIs (i.e., higher level, motor and sensory complete) that require more aggressive catheterization. An individual's gender may also contribute to one's decision to use a particular bladder management method over another, not only from an anatomical standpoint but also socially as well. All of the studies included sample sizes with a greater number of males than females which is consistent with epidemiological studies reporting greater male to female ratios in SCI Males: Females = 3.8:1

(Wyndaele and Wyndaele 2006). However, just one study (Sanchez et al. 2010) compared differences in QoL by gender, as it related to bladder management method; Sanchez et al. (2010) found no significant differences in outcomes by gender. Gender sub-analyses may uncover important sociological factors that contribute to a female's decision which may be largely masked by a male-dominated condition. Gender, along with age and injury severity, is an important area for both quantitative and qualitative study in the future.

Several other issues made it difficult to interpret the findings from the studies selected. While several QoL outcome measures exist, no one was used consistently; five different QoL measures were used among seven studies. Although some of these have been validated, how well their interpretations overlap is questionable; this is especially notable considering that three measures report only on general health-related QoL (i.e., SF-36, KHQ, WHOQOL-BIREF). These outcome measures are not designed to specifically assess QoL in relation to bladder dysfunction in SCI; therefore, they may not be sensitive enough to detect nuances between quality states important to individuals or clinically significant improvements relevant to caregivers and health providers (Andresen and Meyers 2000). Alternatively, the QQ and ICIQ-SF are more suitable for these studies given that they are condition-specific and focus on the impact on QoL as a result of urological dysfunction.

Limitations

Given the systematic nature of the data collection and extraction process, this disciplined approach was intended to reduce any potential bias in the findings reported. However, in the literature search phase it is possible that there were articles missed. Multiple online databases with a variety of key terms were used to reduce the likelihood of this happening. In examining the extraction data, it was not our intent to stratify results based on time since injury. This is an important consideration that may have influenced the findings in this review. For example, it is possible that individuals using one particular form of bladder management for 10 years post SCI had a higher QoL than another individual using a different method for less than 1 year post SCI. Hence, the differences in QoL may have been related to the acceptance and adjustment of that bladder method. This was not explored and could be an area for future consideration.

Conclusions

The decision to use a particular type of bladder management method is multifactorial. The user's choice should reflect not only physiological, safety and practicality considerations but QoL as well. The advantages and disadvantages of all techniques should be reviewed by individuals experienced in managing neurogenic bladders. Furthermore, the technique should be evaluated and revised on an ongoing basis to ensure that individuals utilize the best technique which takes optimal QoL, associated with their technique, into account. Future research should aim to include individuals with SCIs of varying severity, using a wide range of bladder management techniques and urologic-specific QoL outcomes measures.

Conflict of interest None.

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