Bladder drainage options for people with spinal cord injury: A Mini-Review

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Abstract

Neurogenic bladder is one of the negative consequences following a spinal cord injury (SCI). SCI patients who have neurogenic bladder depend on alternative methods to drain urine from their bladder. These include indwelling catheters, reflex voiding , suprapubic tapping and intermittent catheterisation. This review summarizes evidence from the literature of five selected complications (renal failure, urinary tract infections, calculi, urethral stricture, and bladder cancer) that could result from use of the different bladder drainage methods. There is inconsistent evidence to support the superiority of intermittent over indwelling catheterisation on risk of renal impairment, urethral stricture, and renal calculi. Indwelling catheterisations are associated with higher risk of bladder calculi and cancer. Caution needs to be taken when interpreting this review, as many of its findings are from retrospective studies, and more than a decade old. Clinicians need to communicate the evidence to their patients when making the decision on method of bladder drainage.

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Introduction

Spinal cord injury (SCI) is a devastating neurological injury that results in significant changes in the physical, social, psychological, and occupational aspects of a person's life. People rarely make a full recovery from the injury and therefore suffer permanent disabilities such as impairments in mobility, loss of sensation, bowel and bladder dysfunctions, spasticity, chronic pain, and sexual dysfunctions.[1]

Bladder dysfunction, also known as neurogenic bladder is one of the most challenging consequences of SCI. Neurogenic bladder manifests as loss of bladder sensation, inability to voluntarily control urination, high pressure within the bladder, and ineffective detrusor contraction.[2] This abnormal bladder function predisposes the patients to complications such as urinary tract infections, kidney or bladder stones, urinary reflux, and renal impairment.[1,2] Neurogenic bladder management aims to preserve the upper urinary tracts and minimise these secondary complications.

One common impairment related to neurogenic bladder is the inability to empty the bladder, requiring patients to use alternative methods to drain their urine

The common bladder drainage methods (BDM) include clean intermittent catheterisation (CIC), indwelling urinary catheterization (IDUC), suprapubic catheterization (SPC), and reflex voiding (RV) combined with condom, diapers, or incontinence pad to contain the urine.[2,3] In some patients, more invasive methods such as bladder augmentation, intravesical Botulinum Toxin A injection, and urinary diversion are used.[3]

When making the decision on the method of bladder drainage, healthcare professionals (HCP) need consider the type of neurogenic bladder, which is determined by bladder activity and the coordination with bladder neck opening (controlled by the internal and external sphincter). This can be assessed using urodynamic data obtained from objective tests such as a multichannel urodynamic study or bladder diary.[4]

Review of evidence: Complications associated with bladder drainage methods

The section will compare the risks of pre-specified complications between the different BDMs, namely CIC, IDUC, and SPC in persons with SCI. The selected complications are renal impairments, urinary tract infections (UTI), urethral injury and stricture, renal and bladder calculi, and bladder cancer.

Renal impairment

CIC is always considered superior compared to others in the preservation of renal morphology and function. However, there is lack of evidence to support this claim. El-Masri et al.,[2] in 2012, found that with regular surveillance, timely intervention, and easy access to the medical service, could detect complications early, and keep occurrence rates of renal impairment low, regardless of the method

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used. Thus, the occurrence of renal impairment is not associated with the type of BDM. It is possible that the difference in complication rates between bladder drainage options have narrowed due to advancements in catheter care, better detection of early signs of complications, more effective treatment, better patient education and self-care, and a more responsive healthcare system.

Urinary tract infections

There are mixed findings on the relationship between BDM and the occurrence of UTI. A retrospective study by Van Kerrebroeck et al.[5] reported that 22.6% of their participants had UTI, developed between 1 month and 17 years (mean 6.3 years) post-injury. The risk of UTI was similar for those using CIC and other BDMs. A decade later, Drake et al.[6] reported prospective data on patients with SCI for at least 20 years and were followed up for six years. There was no difference in the risk of UTI between subjects using IDUC, IC, straining, and normal voiding, compared to balance reflex voiding. However, a prospective cohort study by Singh et al.[7] reported different findings. Singh et al. found that IDUC users had the most frequent episodes of UTI (2.68 per 100 person-days), followed by SPC (0.56 per 100 person-days), while CIC, condom catheter, and reflex voiding had the least frequency (0.34 per 100 person-days). These differences are likely to be caused by the different study population demographic characteristics, different study methodology and different methods of data analysis.

Urethral stricture

Multiple urethral catheterizations involved in CIC and IDUC are likely to cause urethral injury and stricture. A retrospective study conducted by Weld et al.[8] on patients who had been followed up for an average of 18 years showed there was no significant difference in the risk of urethral stricture between IDUC and CIC (unadjusted OR 2.1, 95% CI 0.96 to 4.45). However, Singh et al.[7] in 2011, reported that IDUC users had a significantly increased risk of developing urethral stricture compared with CIC users (unadjusted OR 1.9, 95% CI 1.08-3.54). It is challenging to determine which one BDM is associated with higher risk due to these three reasons. First of all, none of the studies defined the criteria for diagnosing urethral stricture; making a clinical diagnosis based on difficult catheter insertion is unreliable. Secondly, all the studies stated that their patients changed BDM during the study period, thus any of the BDMs could have caused urethral stricture. Thirdly, there was a great variation in the duration of SCI between the studies.

Renal calculi

There is mixed evidence on the association between BDM and occurrence of renal calculi. A 2000 study by Weld et al.[8] found IDUC significantly increased the risk of developing renal calculi compared with other BDMs: CIC (unadjusted OR 3.7, 95% CI 2.0-6.8); SPC (unadjusted OR 2.1, 95% CI 1.2 - 3.7); and spontaneous voiding (unadjusted OR 4.7, 95% CI 2.5-8.8). Mitsui et al.[9] compared the risk of renal calculi between CIC and SPC users and found no significant difference in the risk of stone formation (unadjusted OR 2.5, 95% CI 0.2-25.0) between the two BDMs. This is further supported by a study by Ku et al.,[10] where they reported IDUC did not significantly increase the risk of renal calculi compared with CIC (adjusted OR 0.5, 95% CI 0.2-1.9), SPC (adjusted OR 1.8, 95% CI 0.6-5.7), crede or reflex voiding (adjusted OR 1.8, 95% CI 0.6-5.9), and condom catheter (adjusted OR 0.7, 95% CI 0.2-3.1).

Bladder calculi

In contrast to renal calculi, there is stronger evidence to suggest that indwelling catheterization is associated with an increased risk of developing bladder stones when compared to non-catheterization methods and CIC. Chen et al.[11] reported that within the first year, when compared with catheter-free subjects, indwelling catheter users were at the highest risk of developing bladder calculi (adjusted RR 8.9, 95% CI 3.4–23.0), followed by IC (adjusted RR 4.7, 95% CI 1.8–12.2). DeVivo et al.[12] also reported that IDUC, compared with normal voiding, was a significant risk factor for bladder calculi formation (adjusted OR 6.1, 95% CI 1.4-25.4) within the first two years after SCI. A study by Ord et al.[13] found that indwelling catheterization had higher risk of bladder calculi formation compared with CIC (p<0.0005), and there was no difference between SPC and IDUC (p=0.6). Mitsui et al.[9] reported SPC as a significant risk factor for bladder calculi formation when compared with CIC (unadjusted OR 4.3, 95% CI 1.5 – 12.9).

Bladder cancer

The use of indwelling catheterization has been associated with an increased risk of developing bladder cancer due to chronic irritation and inflammation. This has led to the practice of performing regular cystoscopy for bladder cancer surveillance. Groah et al.[14] found that those using IDUC compared with those using non-IDUC (i.e. CIC, Crede and spontaneous voiding) were at a higher risk of developing bladder cancer (adjusted RR 4.9, 95% CI 1.3-13.8). They also demonstrated that the risk of bladder cancer increased with the duration of IDUC use. The risk of cancer was 86.8 per 100,000 person-years in those who used IDUC for 10-19 years, which increased to 398.1 per 100,000 person-years in those who used IDUC for more than 20 years (RR=4.6, 95% CI 1.5-14.0). A matched case control study (age, years' post-SCI, gender). reported that IDUC users compared with non-IDUC users had a significantly higher risk of developing bladder cancer

(unadjusted OR 12.8, 95%CI 2.4 – 67.7).[15] The majority of the patients (88%) in their study had used IDUC for more than 18 years. El-Masri et al.[2] reported that 23/25 (93%) of the participants in their study who had bladder cancer used IDUC.

Conclusion

Caution needs to be taken when interpreting this review, as many of its findings are from retrospective studies, which have the lowest level of evidence. Secondly, many of the studies are more than a decade old, and some findings may no longer be relevant, considering the constant improvement in urological care in this population. Thirdly, most of the studies were from the developed countries. This can have limited applicability due to the disparity between the developed and the developing countries in terms of standards of healthcare, available resources, and patients' level of health education.

HCPs must be able to communicate the information about the weaknesses of such evidence to their patients and determine whether the context of the study fits their local settings. If the context differs from theirs, it would be advantageous if they could further determine the factors in their setting that could increase or decrease the risk obtained from the literature. This certainly requires a considerable amount of knowledge and skills from the HCPs as well as personal experience in treating such patients. Practicing evidence-based medicine in this context truly requires a combination of best research evidence, clinical expertise, and patient values.

References

1. Cameron AP, Wallner LP, Forchheimer MB, Clemens JQ, Dunn RL, Rodriguez G, et al. Medical and psychosocial complications associated with method of bladder management after traumatic spinal cord injury. Arch Phys Med Rehabil. 2011;92:449–56.
2. El-Masri(y) WS, Chong T, Kyriakider AE, Wang D. Long-term follow-up study of outcomes of bladder management in spinal cord injury patients under the care of the Midlands Centre for Spinal Injuries in Oswestry. Spinal Cord. 2011;50:14–21.
3. Taweel WA, Seyam R. Neurogenic bladder in spinal cord injury patients. Res Rep Urol. 2015;7:85-99.
4. Wyndaele JJ, Madersbacher H, Kovindha A. Conservative treatment of the neuropathic bladder in spinal cord injured patients. Spinal Cord. 2001; 39: 294-300.
5. Van Kerrebroeck PEV, Koldewijn EL, Scherpenhuizen S, Debruyne FMJ. (1993). The morbidity due to lower urinary tract function in spinal cord injury patients. Paraplegia. 1993;31:320-9.
6. Drake MJ, Cortina-Borja M, Savic G, Charlifue SW, Gardner BP. Prospective evaluation of urological effects of aging in chronic spinal cord injury by method of bladder management. Neurourol Urodyn. 2005;24:111-6.
7. Singh R, Rohilla RK, Sangwan K, Siwach R, Magu NK, Sangwan SS. Bladder management methods and urological complications in spinal cord injury patients. Indian J Orthop. 2011;45: 141-7.
8. Weld KJ, Dmochowski RR. Effect of bladder management on urological complications in spinal cord injured patients. J Urol. 2000; 163: 768-72.
9. Mitsui T, Minami K, Furuno T, Morita H, Koyanagi T (2000). Is Suprapubic Cystostomy an Optimal Urinary Management in High Quadriplegics? Eur Urol. 2000;38: 434-8.
10. Ku JH, Choi WJ, Lee KY, Jung TY, Lee JK, Park WH, Shim HB. (2005). Complications of the upper urinary tract in patients with spinal cord injury: a long-term follow-up study. Uro Res. 2005;33:435-9.
11. Chen Y, DeVivo MJ, Roseman JM. Current trend and risk factors for kidney stones in persons with spinal cord injury: A longitudinal study. Spinal Cord. 2000;38:346–53.
12. DeVivo MJ. The risk of bladder calculi in patients with spinal cord injuries. Arch Intern Med. 1985;145:428–30.
13. Ord J, Lunn D, Reynard J. Bladder management and risk of bladder stone formation in spinal cord injured patients. J Urol. 2003;170:1734–7.
14. Groah SL, Weitzenkamp DA, Lammertse DP, Whiteneck GG, Lezotte DC, Hamman RF. Excess risk of bladder cancer in spinal cord injury: evidence for an association between indwelling catheter use and bladder cancer. Arch Phys Med Rehabil. 2002;83:346-51.
15. Stonehill WH, Goldman HB, Dmochowski RR. The use of urine cytology for diagnosing bladder cancer in spinal cord injured patients. J Urol. 1997;157:2112-4.