

Article

# Factors That Increase the Risk of Ureteric Stent Migration: A Retrospective Cohort Analysis

Sarah Lorger <sup>1,\*</sup> , Paul Kim <sup>2</sup>, Sean Ong <sup>1</sup> , Stuart Jackson <sup>1</sup>, Sithum Munasinghe <sup>3</sup> , Gaeun Song <sup>4</sup> ,  
Tanya Samtani <sup>4</sup>, Fatmah Alzahraa A. Y. Y. Haider <sup>4</sup> and Matthew Stanowski <sup>1</sup>

<sup>1</sup> Department of Urology, Campbelltown Hospital, Campbelltown, NSW 2560, Australia

<sup>2</sup> Department of Urology, Gosford Hospital, Gosford, NSW 2250, Australia

<sup>3</sup> The Translational Health Research Institute, Western Sydney University, Penrith, NSW 2751, Australia

<sup>4</sup> School of Medicine, Western Sydney University, Campbelltown, NSW 2560, Australia

\* Correspondence: sarah.lorger1@my.nd.edu.au; Tel.: +61-412445068

## Abstract

**Background/Objectives:** Ureteric stents are commonly used in urological procedures. However, they can cause pain; haematuria; voiding symptoms; or stent migration. When stent migration occurs, this can cause a significant impact on the patients' therapeutic outcomes and may warrant a repeat procedure to retrieve or replace the ureteric stent. This study aims to assess if there are any patient; stent; or operative factors that may increase the risk of stent migration. **Methods:** This is a single-institute, retrospective cohort study that looked at patient; stent; and operative factors for 828 ureteroscopies and or laser lithotripsy for management of ureteric or intra-renal calculi over a 2-year period. The 828 procedures comprised 655 patients, as some patients had multiple procedures. **Results:** From the 828 cases, there was a 2.7% incidence of stent migration; all episodes of stent migration were distal migration. Stent migration was more likely among females (odds ratio (OR) = 3.0; 95% confidence interval (CI) [1.2; 7.1]) compared to males; older aged groups (over 65 years) (OR = 2.7; 95% CI [0.9; 7.8]) compared to the young aged group (16–44 years); and those who were obese (OR = 2.1; 95% CI [0.9; 5.0]), had musculoskeletal (MSK) conditions (OR = 2.7; 95% CI [0.9; 8.3]), neurological conditions (OR = 3.3; 95% CI [1.1; 10.0]), and stent dwelling time  $\geq$  month (OR = 2.3; 95% CI [0.9; 6.0]) compared to  $<1$  month. There was no observed association between stent and operative factors. **Conclusions:** Patient factors such as sex; age; comorbidities; and weight need to be considered by urologists in conjunction with modifiable stent factors to ensure that the decisions are made on an individual basis to try and reduce the risk of stent migration.

**Keywords:** ureteric stent migration; endoscopic urology; ureteric calculi; intra-renal calculi



Academic Editor: Sanjay Sinha

Received: 8 October 2025

Revised: 20 January 2026

Accepted: 3 February 2026

Published: 20 February 2026

**Copyright:** © 2026 by the authors.

Published by MDPI on behalf of the

Société Internationale d'Urologie.

Licensee MDPI, Basel, Switzerland.

This article is an open access article

distributed under the terms and

conditions of the [Creative Commons](https://creativecommons.org/licenses/by/4.0/)

[Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

## 1. Introduction

Ureteric stents are common and important tools used in both open and endoscopic urology. In endoscopic urology, they are used in the management of ureteric lithiasis, ureteric strictures, external compression from malignancy, and iatrogenic injury, as well as following urethroplasty or ureteric reimplantation [1]. For management of ureteric lithiasis, patients can have a ureteric stent placed to unblock the kidney whilst awaiting definitive laser lithotripsy, or they can be placed following ureteroscopy and laser lithotripsy. Following ureteroscopy, between 70 and 80% of urologists will leave a ureteric stent [2,3].

Unfortunately, ureteric stents are often symptomatic and can cause a negative impact on the patients' quality of life when they are in situ [1,4]. Symptoms include haematuria,

irritative voiding symptoms, pain or discomfort, bacterial colonisation and stent migration. Stent migration is seen as one of the major complications [1,4] as patients may require repeat surgical procedures for retrieval or replacement of ureteric stents. The rates of stent migration vary in the literature but range between 1.6 and 5.8% [1].

Ureteric stent factors, including ureteric length, diameter and use of an extraction string, have previously been studied to assess how these modifiable variables affect stent migration [2,4,5]. Most of the previous literature focuses on these modifiable variables rather than patient or operative factors. Our objective is to assess the prevalence of stent migration at a single centre and to determine if there are any patient factors (including age, sex, comorbidities or body mass index (BMI)) or operative factors (brand of ureteric stent, stent dwell time, use of access sheath or operative time) that may increase the risk of ureteric stent migration.

## 2. Objectives

The primary objective is to evaluate if there are any patient or operative factors that increase the risk of ureteric stent migration.

We hypothesise that females and obese patients will be more likely to experience stent migration. This is due to females having shorter urethras and the assumption that the distal coil can more easily dislodge. For obese patients, the assumption is that the string may be more difficult to secure and more frequently dislodged if patients are unable to visualise the string attachment.

Secondary objectives were to assess the prevalence of stent migration in this cohort and compare the findings to the current literature.

## 3. Materials and Methods

This is a single-institute, retrospective cohort study that examines the patient factors (including sex, age, comorbidities and BMI) and operative factors (including brand of ureteric stent, stent dwell time, use of access sheath or operative time) of 828 cases who underwent ureteroscopy and or laser lithotripsy and required a ureteric stent to be placed for the management of ureteric or intra-renal calculi. The comorbidities that were included were neurological conditions and musculoskeletal (MSK) conditions. Other conditions, such as vision and hearing impairment and dementia, were analysed; however, no patients with stent migration had these conditions. Therefore, statistical association could not be assessed. The 828 cases comprised 655 patients, as there were patients who underwent multiple procedures. Cases were reviewed over a 2-year period (January 2023 through to December 2024).

Stent migration was defined as any unintended displacement of a ureteric stent from its intended position, either proximally into the renal pelvis or distally into the bladder, urethra or complete expulsion from the body. Stent migration may be identified clinically with a new onset of incontinence, flank pain, fever or other symptoms that prompt radiological evaluation or may be identified in an asymptomatic patient incidentally via radiological evaluation.

At this institution, patients undergo an intra-operative X-ray during and after stent placement to radiologically confirm the placement of the proximal and distal coils. Positioning of the proximal coil is satisfactory when it is within the renal pelvis or any calyx and is proximal to any points of obstruction. Patients do not undergo routine postoperative imaging; therefore, identification is largely due to clinical presentation.

Patient factors and operative factors were analysed to assess whether there are any statistical variables that put patients at higher risk of experiencing stent migration.

Inclusion criteria were broad, including all episodes of ureteroscopy and/or laser lithotripsy in patients with ureteric or intra-renal stones at this institution between the allocated time frames (January 2023 through to December 2024). The institute is a tertiary hospital located in Sydney, Australia.

Renal transplant patients are not included, as this tertiary hospital does not manage renal transplant patients; they are referred to their urological transplant service. All other urological malformations (e.g., reimplantation and previous pyeloplasty) were not excluded; however, this data was not specifically extracted.

Ureteric stents are generally placed by trainee Urology Registrars (compared to consultants). The skill level can vary substantially between trainees. Unaccredited Urology Registrars may have 1–2 years of specific urological experience, whereas accredited Urology Registrars may have between 3 and 7+ years of specific urological experience. Unfortunately, skill level was not included, as this is difficult to extract from the electronic medical record, as each registrar is given the title of “trainee specialist” despite the number of years of training.

Regarding BMI, a healthy BMI is 18.5–24.9, an overweight BMI is 25–29.9, and an obese BMI is 30 and above.

#### *Statistical Analysis*

Preliminary analyses summarised counts and percentages of study factors and stratified them by stent migration. Given that each individual may have multiple stent migration incidences over the study period, this study employed generalised estimating equations with a logistic link function and an exchangeable correlation matrix to examine the association between study factors and stent migration. Effect sizes of the association were presented using Odds Ratios (ORs) and 95% Confidence Intervals (CIs). All statistical analyses were conducted using Stata16.1 (Stata Corp., 4905 Lakeway Drive, College Station, TX 77845, USA) and R 4.2.3 (R Development Core Team. R: a language and environment for statistical computing, Vienna, Austria: R Foundation for Statistical Computing. 2011).

## 4. Results

The study comprised 655 patients, with 828 cases of ureteroscopy and/or laser lithotripsy that required ureteric stent insertion. The patient demographics are presented in Table 1. Male patients represented 59.9% of the cohort, and the median age was 54 years. The median BMI was 28.5.

**Table 1.** Patient demographics.

| Patient Characteristics |                 |
|-------------------------|-----------------|
| Patients                | 655             |
| Sex *                   |                 |
| Male                    | 390             |
| Female                  | 261             |
| Age median (IQR)        | 54 (42, 65.5)   |
| BMI median (IQR)        | 28.5 (25.4, 33) |

\* Missing data for 4 patients; IQR: interquartile range.

There were 23 cases of stent migration, which is 2.7% of the overall cases. For those who experienced ureteric stent migration, all episodes were distal migration, as detailed in Table 2. One patient was asymptomatic and noticed they had completely dislodged their own stent. The remaining 22 patients were symptomatic, re-presenting to the Emergency Department with new-onset incontinence, flank pain, fever or haematuria. Stent migration was confirmed via abdominal X-ray and Computed Tomography Kidney Ureter Bladder

(CTKUB), or if patients had complete dislodgement of their ureteric stent, confirmed via flexible cystoscopy. The majority of patients were managed conservatively, with the ureteric stent not being replaced; they were observed and treated with prophylactic antibiotics. Four patients required a stent to be replaced in the operating theatre; these were all due to having fevers and imaging confirming stent migration and an obstructed system, as seen in Table 2. The patient and operative factors for those who had stent migration are seen in Table 3. For those with stent migration, 8 were male (34.8%) and 15 were female (65.2%). There were 5 episodes of stent migration in the age 16–44 years (21.7%), 7 episodes in the age 45–64 years (30.4%) and there were 11 episodes aged 65 and older (47.8%). There were 9 episodes of stent migration in the normal and overweight group (39.1%) and 14 episodes in the obese group (60.9%)

**Table 2.** Identification of stent migration and outcome.

| Identification of Stent Migration and Clinical Outcome |    |
|--------------------------------------------------------|----|
| Type of migration                                      |    |
| Distal                                                 | 23 |
| Proximal                                               | 0  |
| Primary symptomatic complaint                          |    |
| Incontinence                                           | 13 |
| Flank pain                                             | 4  |
| Fever                                                  | 4  |
| Haematuria                                             | 1  |
| Asymptomatic                                           | 1  |
| Confirmation of stent migration                        |    |
| Complete dislodgement of stent                         | 10 |
| Abdominal X-ray                                        | 7  |
| CTKUB                                                  | 4  |
| Confirmed on flexible cystoscopy                       | 2  |
| Management                                             |    |
| Conservative management                                | 19 |
| Return to OT for replacement of ureteric stent         | 4  |

CTKUB: Computed Tomography Kidney Ureter Bladder; OT: operating theatre.

**Table 3.** Patient and case factors of those who had stent migration.

| Characteristics | Stent Migration |           | Total      |
|-----------------|-----------------|-----------|------------|
|                 | No              | Yes       |            |
| Gender          |                 |           |            |
| Male            | 488 (61.1)      | 8 (34.8)  | 496 (58.4) |
| Female          | 311 (38.9)      | 15 (65.2) | 326 (38.4) |
| Age             |                 |           |            |
| 16–44           | 254 (31.6)      | 5 (21.7)  | 259 (30.2) |
| 45–64           | 343 (42.6)      | 7 (30.4)  | 350 (40.8) |
| 65+             | 208 (25.8)      | 11 (47.8) | 219 (25.5) |
| Obese           |                 |           |            |
| No              | 451 (57.7)      | 9 (39.1)  | 460 (55.6) |
| Yes             | 330 (42.3)      | 14 (60.9) | 344 (41.5) |
| Cook vs. Boston |                 |           |            |
| No              | 732 (92.2)      | 20 (87)   | 752 (90.6) |
| Yes             | 62 (7.8)        | 3 (13)    | 65 (7.8)   |

**Table 3.** *Cont.*

| Characteristics             | Stent Migration |           | Total      |
|-----------------------------|-----------------|-----------|------------|
|                             | No              | Yes       |            |
| Access sheath               |                 |           |            |
| No                          | 136 (17.3)      | 5 (23.8)  | 141 (17.2) |
| Yes                         | 652 (82.7)      | 16 (76.2) | 668 (81.4) |
| Operative time              |                 |           |            |
| ≤45                         | 466 (59.3)      | 11 (52.4) | 477 (58.3) |
| >45                         | 320 (40.7)      | 10 (47.6) | 330 (40.3) |
| Stent dwell time (months)   |                 |           |            |
| <1                          | 358 (45)        | 6 (26.1)  | 364 (43.8) |
| ≥1                          | 438 (55)        | 17 (73.9) | 455 (54.8) |
| Musculocutaneous conditions |                 |           |            |
| No                          | 749 (92.8)      | 19 (82.6) | 768 (89.1) |
| Yes                         | 58 (7.2)        | 4 (17.4)  | 62 (7.2)   |
| Mental health conditions    |                 |           |            |
| No                          | 760 (94.2)      | 23 (100)  | 783 (90.8) |
| Yes                         | 47 (5.8)        | 0 (0)     | 47 (5.5)   |
| Neurological conditions     |                 |           |            |
| No                          | 757 (93.8)      | 19 (82.6) | 776 (90)   |
| Yes                         | 50 (6.2)        | 4 (17.4)  | 54 (6.3)   |

The univariate logistic regression to determine the association between stent migration and study variables is seen in Table 4. Stent migration was more likely among females (OR = 3.0; 95% CI [1.2, 7.1]) compared to males, older groups (over 65 years) (OR = 2.7; 95% CI [0.9, 7.8]) compared to the young groups (16–44 years), and those who were obese (OR = 2.1; 95% CI [0.9, 5.0]), had MSK conditions (OR = 2.7; 95% CI [0.9, 8.3]) or neurological conditions (OR = 3.3; 95% CI [1.1, 10.0]), and had stent dwelling time ≥ month (OR = 2.3; 95% CI [0.9, 6.0]) compared to <1 month. There was no observed association between stent and operative factors.

**Table 4.** Univariate generalised estimating equations to examine the association between stent migration and study variables.

| Characteristics | OR             | <i>p</i> -Value |
|-----------------|----------------|-----------------|
| Gender          |                |                 |
| Male            | 1 (1, 1)       |                 |
| Female          | 3 (1.2, 7.1)   | 0.014           |
| Age             |                |                 |
| 16–44           | 1 (1, 1)       |                 |
| 45–64           | 1 (0.3, 3.3)   | 0.953           |
| 65+             | 2.7 (0.9, 7.8) | 0.072           |
| Obese           |                |                 |
| No              | 1 (1, 1)       |                 |
| Yes             | 2.1 (0.9, 5)   | 0.083           |

**Table 4.** *Cont.*

| Characteristics           | OR             | <i>p</i> -Value |
|---------------------------|----------------|-----------------|
| Cook vs. Boston           |                |                 |
| No                        | 1 (1, 1)       | 0.367           |
| Yes                       | 1.8 (0.5, 6.1) |                 |
| Access sheath             |                |                 |
| No                        | 1 (1, 1)       | 0.44            |
| Yes                       | 0.7 (0.2, 1.9) |                 |
| Operative time            |                |                 |
| ≤45                       | 1 (1, 1)       | 0.524           |
| >45                       | 1.3 (0.6, 3.2) |                 |
| Stent dwell time (months) |                |                 |
| <1                        | 1 (1, 1)       | 0.078           |
| ≥1                        | 2.3 (0.9, 6)   |                 |
| MSK conditions            |                |                 |
| No                        | 1 (1, 1)       | 0.077           |
| Yes                       | 2.7 (0.9, 8.3) |                 |
| Neuro conditions          |                |                 |
| No                        | 1 (1, 1)       | 0.038           |
| Yes                       | 3.3 (1.1, 10)  |                 |

OR: odds ratio; MSK: musculocutaneous.

## 5. Discussion

The use of ureteric stents is vital for urological pathologies and ensuring the success of urological interventions. However, they have a significant impact on patients' quality of life, including pain, haematuria, infection, voiding symptoms, stent failure and stent migration [1,4]. Stent migration can have an even more significant impact on patient care, as this may cause patients' ureteric stents to have suboptimal effects, which may require them to undergo a repeat procedure under general anaesthetic to retrieve or replace the ureteric stent. Our study adds to the current understanding of factors associated with stent migration by demonstrating comorbidity risk groups, which may be considered by clinicians during patient selection and stent selection in calculi management.

Given the significant impact on patient care and quality of life for patients who experience stent migration, our research aims to identify whether there are any patient factors (including demographics, limited comorbidities, and neurological and MSK conditions) or operative factors that may increase the risk of stent migration. The incidence of stent migration in our cohort was 2.7%. The incidence of stent migration in the literature varies, as sometimes only proximal stent migration is reported. However, for those reporting both proximal and distal migration, our incidence is within the literature range, which is 1.6–5.8% of cases [1]. Of note, our episodes of stent migration are mainly identified by a new onset or change in symptoms (incontinence, fever, flank pain, etc.) that prompts radiological evaluation. In our study, only one patient was identified with asymptomatic stent migration.

Primarily, the literature has assessed modifiable stent factors such as use of an extraction string, stent length and stent diameter and how these factors contribute to stent symptoms and stent migration. Table 5 summarises previous studies [1,2,5–10]. Barnes et al. [2] conducted a randomised controlled study comparing the use of a ureteric extraction string versus no extraction string. Participants who were randomised to the ureteric string

group self-removed their stents at home on post-operative day 7, and those randomised to no string had an in-office cystoscopy to remove the stent between post-operative days 7 and 14. This study showed statistical significance for stent dislodgement in the ureteric string group; however, no participants required the stent to be reinserted. Dellis et al. [3] performed a systematic review and meta-analysis comparing stents on a string to non-string stents. The meta-analysis of two studies reported that stent migration was more frequent in the string group; however, this was not statistically significant.

**Table 5.** Summary of current literature.

| Study                | Year | Type of Study                             | Number of Participants | Variable Assessed                                                                              | Outcomes                                                                                                                                        |
|----------------------|------|-------------------------------------------|------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Calvert et al. [5]   | 2012 | Prospective randomised control trial      | 162 patients           | Effect of stent length (24 cm vs. multilength stent) on stent symptoms                         | No difference in stent-related quality of life/symptoms                                                                                         |
| Barnes et al. [2]    | 2013 | Prospective randomised control trial      | 68 patients            | Effect of ureteric stent extraction strings                                                    | No difference in stent-related quality of life. 7.35% (n = 5) reported early inadvertent stent removal                                          |
| Kawahara et al. [6]  | 2016 | Prospective review                        | 162 patients           | Effect of stent length on stent migration                                                      | Stents that were more than 2 cm shorter than actual ureteric length had significantly increased incidence of stent migration                    |
| Barrett et al. [7]   | 2016 | Prospective review                        | 57 patients            | CT measurement vs. height to measure ideal ureteric stent length                               | Stent selection with ureters measured by CT is associated with high rates of ideal stent position                                               |
| Geavlete et al. [1]  | 2021 | Retrospective review                      | 50,000 procedures      | N/A                                                                                            | Proximal migration occurred in 0.9% of cases, distal migration in 0.7% of cases.                                                                |
| Shah et al. [8]      | 2022 | Prospective randomised trial              | 124 patients           | Effect of intra-ureteric stent placement (no distal ureteric coil)                             | Lower rates of stent symptoms and decreased duration of time off work compared to conventional double-J ureteric stents                         |
| Zhu et al. [9]       | 2023 | Original article—findings from simulation | N/A                    | Effect of ureteric stent length on migration                                                   | Increased rates of stent migration with shorter ureteric stents                                                                                 |
| Caceiro et al. [10]  | 2025 | Prospective randomised cohort study       | 32 patients            | Effect of intra-ureteric stent (no distal ureteric coil)                                       | Lower rates of stent symptoms, patients who received previously double-J stent followed by intra-ureteric stent preferred intra-ureteric stent. |
| Wu et al. [11]       | 2021 | Retrospective review                      | 61 stents              | Age, gender, cancer type, hydronephrosis grade, obstruction site, pyuria, unilateral/bilateral | Increased rates of stent migration for moderate and severe hydronephrosis, pre-operative pyuria and lower ureteric obstruction                  |
| Sendogan et al. [12] | 2019 | Retrospective review                      | 428 patients           | Age, gender, BMI, height, laterality, stone size, stone location, hydronephrosis grade         | Increased rates of stent migration with increased stone size and hydronephrosis grade                                                           |

CT: computed tomography; N/A: not applicable; BMI: body mass index.

Calvert et al. [5] assessed whether excessive redundant intravesical stents contributed to stent-related symptoms. They conducted a randomised control study comparing stent-related symptoms following the use of a multi-length or 24 cm fixed-length ureteric stent. There were no episodes of stent migration seen in either the multi-length group (51 patients) or the 24 cm fixed-length group (62 patients). Finally, Diatmika et al. [4] performed a systematic review assessing stent-related outcomes and comparing different ureteric stent

diameters. They did not find any statistical differences in stent migration for smaller ureteric stent sizes.

There has been very limited research assessing clinical factors that may increase the risk of ureteric stent migration. Wu et al. [11] assessed clinical predictors for stent failure in patients with external ureteral compression; they found that moderate and severe hydronephrosis, pre-operative pyuria and lower ureteric obstruction were significant factors for ureteric stent failure. Although this is an important study, it looks at a very different demographic compared to our study; age and sex were the only variables that were consistent between the two studies. Sendogan et al. [12] assessed factors that caused spontaneous migration of double-J stents after Retrograde Intra-renal Surgery; they found an association between stent migration and increased stone size and degree of hydronephrosis. These two factors were not explored in our study. Interestingly, they also assessed BMI, age and sex, and did not find an association. We assessed sex, age, limited comorbidities and BMI. The comorbidities that were statistically assessed were neurological and MSK conditions. As mentioned previously, data was collected for vision and hearing impairment and dementia; however, statistical association could not be assessed as no patients with stent migration had these comorbidities.

Stent migration was more likely among females compared to males. We suspect that stent migration is more frequent in women due to a shortened urethra. Stent migration was more likely in patients older than 65 and those who were obese. We hypothesise that there is likely an increased risk of dislodgement with wiping after toileting and difficulty seeing the attached string in overweight or elderly patients. Patients with musculoskeletal conditions and neurological conditions also had an increased rate of migration, likely secondary to reduced dexterity. Finally, stent migration was more likely when stent dwell time was  $\geq 1$  month compared to  $< 1$  month, likely due to increased risk of distal or proximal migration the longer the stent is in situ. There was no observed association between stent and operative factors. Despite the large number of patients in this study, it is hypothesised that more patient data may be needed to potentially demonstrate an association with stent and operative factors. Patient data could be increased with the creation of a universal stent registry. However, registries rely on either manual data entry or automatic alerts from electronic medical record systems. In Australia, there is no universal electronic medical record system; therefore, an accurate registry would rely on manual entry and patients self-identifying if they have presented to other health networks.

The aim of our study was to assess risk factors for stent migration. In the methodology, we did not separate between symptomatic and asymptomatic presentations. However, as seen with the results only, one patient was asymptomatic. Our study largely looks at symptomatic patients; however, this was not specified as an inclusion criterion, and therefore it is important to include the single asymptomatic patient. At our institution, all temporary ureteric stents use an extraction string, which, unless the patient develops new symptoms (flank pain, fevers, etc.) or the stent has migrated distal to the urethra, a patient may not be aware of stent migration. There is likely a group of patients who have experienced asymptomatic distal migration (with either partial or complete migration of their stent into the bladder) and are not reported in this study. Sendogan et al. [12] found that 7 of their 28 patients experienced asymptomatic distal migration of ureteric stents. This demonstrates that there is likely a group of patients who experienced asymptomatic stent migration that are not captured in our study. This needs to be considered when applying these results to clinical practice.

Assessing and analysing the experience of urological trainees would be very impactful, as this may identify an area that could be improved with more supervision or closer review of technique. However, this study was not able to assess their experience due to

limitations of the electronic medical records, as each registrar is designated the title of “trainee specialist” regardless of their number of years of training. Furthermore, at this institution, an intra-operative X-ray is used to confirm proximal stent placement, confirming that a proximal coil is within the renal pelvis or any calyx (as long as it is proximal to any point of obstruction); however, it would be valuable to review the exact proximal coil placement in future research to ascertain whether there was a significant difference between placement in the renal pelvis or upper, middle or lower calyx.

Based on the authors’ experience, the literature, and this analysis, we have documented recommendations aimed at reducing the risk of stent migration; these recommendations are seen in Table 6.

**Table 6.** Recommendations to reduce the risk of stent migration.

| Recommendations to Reduce the Risk of Stent Migration |                                                                                                                                                                                  |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Patient selection                                     | Consider need for stent prior to procedure.                                                                                                                                      |
|                                                       | Consider comorbidities, pathology and patient factors, including MSK/neurological conditions/age/weight, etc and whether stent on string is ideal for patient.                   |
| Placement of string                                   | In females, the string should be secured to the labia or pubic area.                                                                                                             |
|                                                       | In males, the string should be secured to the penis (with laxity in the string).                                                                                                 |
| Aftercare                                             | The area that the string is secured should be clean, dry and hair-free (may require shaving prior to application).                                                               |
|                                                       | The string should be secured with steristrips and a fixation type (for example, hypafix)                                                                                         |
|                                                       | When showering and drying, pat area only (no rubbing)                                                                                                                            |
|                                                       | Pat dry after toileting (no wiping)                                                                                                                                              |
|                                                       | No sexual intercourse or high-risk physical activity (for example, squats and running)                                                                                           |
|                                                       | Patients to be provided with information sheet after operation regarding the string, common side effects, ways to minimise stent dislodgement and when to seek medical attention |

MSK: musculocutaneous.

It is likely that patient factors have received less emphasis in the research because they are non-modifiable. Consequently, the focus has been on stent-related factors such as length, diameter, and the use of an extraction string—all of which can be adjusted to optimise outcomes based on current evidence. However, it is still important to identify whether there are patient factors that make one more susceptible to stent migration, as this can change how patients are selected, counselled and treated and impact overall ureteric stent management. Given current health dynamics, including an ageing population and increased comorbidities and rates of obesity, stent migration rates may potentially increase in the future. Therefore, the option to not place a stent or remove a ureteric stent via flexible cystoscopy should be considered for high-risk patients. If a stent with an extraction string is to be placed, then the recommendations listed in Table 6 can be used and tailored to individuals to help reduce stent migration.

The combination of patient factors, in addition to the modifiable variables such as stent length, diameter and use of extraction strings, should all be considered when selecting which patients need ureteric stents. Furthermore, ureteric stent characteristics, dwell time and use of extraction string should be considered on an individual basis to reduce the risk of stent migration as much as possible and avoid further negative impacts on quality of life.

Our study’s strength includes the sample size of 828 cases in a single institution and the unique focus on patient and operative factors. Our study has limitations as it is

retrospective in nature. Furthermore, our cohort study only included the use of ureteric stents for the management of stone disease. While this is the most common use of these devices, ureteric stents can be used in a variety of other conditions (e.g., strictures or malignancy), which may alter results. Whilst requiring further investigation, we suggest that the effects of dexterity and cognition-related comorbidities highlighted in our work may carry over to these cohorts despite these pathology differences. While our study explored comorbidity groupings, there needs to be further research to assess whether there are other specific patient factors that may contribute to stent migration, particularly specific diseases or mental health conditions. However, a larger cohort would be needed to statistically analyse these factors. The use of large-scale registries may be useful in gathering further information, but these also have limitations regarding correct usage and ensuring all presentations are captured accurately across many health services.

## 6. Conclusions

Our research found that the incidence of stent migration is 2.7%, which is in line with the current literature. We found that there was an increased risk of stent migration for female, elderly or obese patients; patients with musculoskeletal, neurological or mental health conditions; and patients with a stent dwell time of over 1 month. This research highlights the importance of investigating patient factors that may contribute to stent migration and using this information to counsel and create tailored management plans for high-risk patients.

**Author Contributions:** Conceptualisation, S.L., P.K., S.O. and S.J.; data curation, G.S., T.S. and F.A.A.Y.Y.H.; statistical analysis, S.M.; writing—original draft preparation, S.L. and P.K.; writing—review and editing, S.O. and S.J.; supervision, M.S. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** In accordance with the guidance provided in Section 2 (e) of the National Health and Medical Research Council “Ethical Considerations in Quality Assurance and Evaluation Activities”, the current project is a Quality Assurance activity and as such ethical review is not required.

**Informed Consent Statement:** Patient consent was waived as this is a retrospective cohort study, all patients were deidentified and no sensitive information was used during this study.

**Data Availability Statement:** Dataset available on request from the authors.

**Conflicts of Interest:** The authors declare no conflicts of interest.

## Abbreviations

The following abbreviations are used in this manuscript:

|       |                                           |
|-------|-------------------------------------------|
| BMI   | Body Mass Index                           |
| MSK   | Musculoskeletal                           |
| OR    | Odds Ratio                                |
| CI    | Confidence Interval                       |
| CTKUB | Computed Tomography Kidney Ureter Bladder |
| CT    | computed tomography                       |
| IQR   | interquartile range                       |
| OT    | operating theatre                         |

## References

1. Geavlete, P.; Georgescu, D.; Muțescu, R.; Stănescu, F.; Cozma, C.; Geavlete, B. Ureteral stent complications—experience on 50,000 procedures. *J. Med. Life* **2021**, *14*, 769–775. [[CrossRef](#)] [[PubMed](#)]
2. Barnes, K.T.; Bing, M.T.; Tracy, C.R. Do ureteric stent extraction strings affect stent-related quality of life or complications after ureteroscopy for urolithiasis: A prospective randomised control trial. *BJU Int.* **2014**, *113*, 605–609. [[CrossRef](#)] [[PubMed](#)]
3. Dellis, A.; Kallidonis, P.; Adamou, C.; Kostakopoulos, N.; Kotsiris, D.; Ntasiotis, P.; Papatsoris, A.G.; Urolithiasis and Endourology Working Party of the European Association of Urology (EAU) Young Academic Urologists (YAU). The efficacy and safety of string stents after retrograde intrarenal surgery for urolithiasis. *Minerva Urol. Nephrol.* **2020**, *72*, 451–463. [[CrossRef](#)] [[PubMed](#)]
4. Diatmika, A.A.N.O.; Djojodimedjo, T.; Kloping, Y.P.; Hidayatullah, F.; Soebadi, M.A. Comparison of ureteral stent diameters on ureteral stent-related symptoms: A systematic review and meta-analysis. *Urol. Res. Pract.* **2022**, *48*, 30–40.
5. Calvert, R.C.; Wong, K.Y.; Chitale, S.V.; Irving, S.O.; Nagarajan, M.; Biyani, C.S.; Browning, A.J.; Young, J.G.; Timoney, A.G.; Keeley, F.X.; et al. Multi-length or 24 cm ureteric stent? A multicentre randomised comparison of stent-related symptoms using a validated questionnaire. *BJU Int.* **2013**, *111*, 1099–1104. [[CrossRef](#)] [[PubMed](#)]
6. Kawahara, T.; Sakamaki, K.; Ito, H.; Kuroda, S.; Terao, H.; Makiyama, K.; Uemura, H.; Yao, M.; Miyamoto, H.; Matsuzaki, J. Developing a preoperative predictive model for ureteral length for ureteral stent insertion. *BMC Urol.* **2016**, *16*, 70. [[CrossRef](#)] [[PubMed](#)]
7. Barrett, K.; Foell, K.; Lantz, A.; Ordon, M.; Lee, J.Y.; Pace, K.T.; Honey, R.J.D. Best Stent Length Predicted by Simple CT Measurement Rather than Patient Height. *J. Endourol.* **2016**, *30*, 1029–1032. [[CrossRef](#)] [[PubMed](#)]
8. Shah, M.; Pillai, S.; Chawla, A.; de la Rosette, J.J.M.C.H.; Laguna, P.; Reddy, S.J.; Taori, R.; Hegde, P.; Mummalaneni, S. A randomized trial investigating clinical outcomes and stent-related symptoms after placement of a complete intra-ureteric stent on a string versus conventional stent placement. *BJU Int.* **2022**, *129*, 373–379. [[CrossRef](#)] [[PubMed](#)]
9. Zhu, L.; Wang, L.; Gao, Y.; Feng, W.; Fan, Y. Effect of ureteral stent length and implantation position on migration after implantation. *Med Biol. Eng. Comput.* **2023**, *61*, 2067–2076. [[CrossRef](#)] [[PubMed](#)]
10. Caceiro, R.; Baltazar, P.M.; Pinheiro, L.C. IP08-36 UROSTENT STUDY: A PROSPECTIVE, RANDOMIZED COMPARISON OF CONVENTIONAL STENTS VS PIGTAIL SUTURE STENTS. *J. Urol.* **2025**, *213*, e431. [[CrossRef](#)]
11. Wu, K.J.; Chen, Y.Z.; Chen, M.; Chen, Y.H. Clinical factors predicting ureteral stent failure in patients with external ureteral compression. *Open Med.* **2021**, *16*, 1299–1305. [[CrossRef](#)] [[PubMed](#)]
12. Şendoğan, F.; Turan, T.; Efiloğlu, Ö.; Atış, G.; Çaşkurlu, T.; Yıldırım, A. An Exploration of Factors That Cause the Spontaneous Migration of Double-J Stents After Retrograde Intrarenal Surgery. *J. Clin. Pract. Res.* **2019**, *41*, 398–401. [[CrossRef](#)]

**Disclaimer/Publisher’s Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.