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Does 2% Lignocaine Gel Reduce Urethral Catheterisation Pain in Women? A Systematic Review and Meta-Analysis

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ABSTRACT

Urinary catheterisation is an important aspect of patient care yet commonly causes discomfort or pain. Current international guidelines recommend water-based sterile lubricant during catheterisation of women, whereas local anaesthetic gel (e.g., lignocaine gel) is advocated in men, potentially highlighting a gender bias in clinical care. The purpose of this systematic literature review was to evaluate the effectiveness of 2% lignocaine gel compared to water-based lubricant in reducing pain during urethral catheterisation of women. A systematic search using key terms and their alternate spellings was used to identify relevant studies. Studies were included that examined the use of 2% lignocaine during urethral catheterisation of women. This review searched Cochrane Library, Cumulated Index in Nursing and Allied Health Literature (CINAHL), Emcare Nursing and Allied Health Database, Excerota Medica Database (EMBASE), Maternity and Infant Care Database, MEDLINE, OVID, ProQuest, PubMed and SCOPUS. In addition, clinical trial and systematic review registries were also searched from inception to May 2025. A total of 2030 studies were identified and screened. Three randomised controlled studies involving 214 female participants were included in this review. Pooled results indicated a statistically significant difference in favour of 2% lignocaine gel compared to water-based lubricant during urethral catheterisation in women (mean difference −10.81, 95% CI: −15.81 to −5.35). The application of 2% lignocaine gel is more effective in reducing catheterisation-associated pain in women compared to water-based lubricant. Current clinical guidelines suggest the use of a water-based lubricant for women, but an anaesthetic-based lubricant for men. The belief that women do not require local anaesthesia before catheterisation may be influenced by historical perspectives and warrants further investigation.

1 | Introduction

Urinary catheterisation is an important aspect of patient care and is frequently performed by nurses for a variety of clinical reasons, including: management of urinary retention or obstruction, fluid balance monitoring in acutely ill patients, injury, surgery or disease affecting the spinal cord and urinary function, to aid healing of perineal or sacral wounds, or to provide comfort and dignity at the end of life [1, 2]. Point prevalence surveys have reported 20% to 26% of acute care patients admitted to a hospital in Australia have a urinary catheter [3, 4]. In addition to being an invasive procedure, urethral catheterisation can be painful [5, 6]; the intensity of which may be underappreciated by nurses and other healthcare professionals [7, 8]. The effectiveness of using 2% lignocaine gel to reduce pain for women during urethral catheterisation has not reached consensus. Current international guidelines recommend using water-based lubricants for women during urethral catheterisation, while advocating for anaesthetic-based lubricants such as 2% lignocaine for men [9–11], highlighting a potential gender bias in clinical practice.

Summary

- What is currently known?
  - Nurses frequently perform urinary catheterisation for various clinical reasons. In Australia, about 12% to 20% of hospital patients have urinary catheters, of which up to 40% occur in women.
  - To reduce pain and urethral trauma during catheterisation, use of sterile lubricant is standard practice. Historically, however, urethral catheterisation in women was undertaken without lubrication.
- What does this article add?
  - This review found 2% lignocaine gel more effective in reducing catheterisation associated pain in women compared to using water-based gel lubrication.
  - Current international guidelines recommend water-based lubricants for women, and anaesthetic-based lubricants for men during urethral catheterisation, highlighting a potential gender bias in clinical practice. The belief that women do not need local anaesthetic before catheterisation may be based on historical views and should be examined further.

2 | Background

Overall, up to a quarter of urethral injuries result from trauma during catheter placement by healthcare providers [12]. To reduce pain and urethral trauma during catheterisation, the use of sterile lubricant is standard practice. Historically, however, urethral catheterisation in women was undertaken without lubrication [13, 14]. While anaesthetic lubricants have long been used when undertaking urethral catheterisation in men, it was not until the 1990s that their use in female urinary catheterisation gained attention [14]. The female urethra is shorter compared to the male urethra [15], and this may have led to the assumption that catheterisation would be less painful and/or traumatic; however it is lined with urothelium. The urothelium is a specialised lining of the urinary tract, extending from the renal pelvis to the urethra [16]. Urothelium produces mucin that acts as a protective barrier preventing bacterial attachment and contributes to the viscoelastic properties of mucus that lubricates the vagina. Vaginal lubrication is an oestrogen-dependent physiological process that is essential for maintaining a balanced microbiome in the vagina, and integrity and lubrication of the vaginal epithelium and collagen production [17]. Decreases in oestrogen levels, which can occur at any age, can be triggered by various factors such as psychological stress [18], eating disorders [19], perimenopause and menopause [20], childbirth and breastfeeding [21], oophorectomy, medications [20], and autoimmune disorders (e.g., Sjogren's syndrome [22], lupus [23]), can lead to progressive atrophying of urogenital tissues including the urethra. Further, the female urethra lies flat in unequal folds that can easily become damaged during catheterisation causing pain to the patient, and the development of strictures.

To reduce urethral trauma, pain and discomfort an analgesic lubricant such as 2% lignocaine gel is recommended prior to the insertion of a urinary catheter in men; however its use in urethral catheterisation in women has been controversial [2]. A previous systematic literature review examined the use of 2% lignocaine gel versus water-based lubricant during urethral catheterisation of women and the impact on procedural pain, finding minimal benefit [24]. However, the review predominantly focused on diagnostic procedures involving cystoscopy and urodynamic investigations, procedures typically not undertaken by nurses, involving extended instrumentation (e.g., cystoscope) and manipulation of the urethra and bladder, often with larger diameters compared to urinary catheters [25, 26].

To date, it remains unclear whether the use of 2% lignocaine gel reduces pain in women undergoing urethral catheterisation. Therefore, this systematic review aims to evaluate the effectiveness of 2% lignocaine gel compared to water-based lubricant on reducing pain during urethral catheterisation of women.

3 | Methods

This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-analysis guidelines [27]. Search methods, study eligibility criteria, outcomes to be reported, and methods of data collection and analysis were specified a priori and documented in a protocol. The protocol for the systematic review is registered on Joanna Briggs Institute (JBI) Systematic Review Register.

3.1 | Search Strategy and Information Sources

The following search strategy was developed and adapted for each database syntax: (lignocaine OR xylocaine OR lidocaine OR anaesthetic OR anaesthetic) AND (urethral OR urinary OR indwelling OR foley) AND (catheter OR catheterisation OR catheterization) AND (women OR female OR woman OR females) AND (pain). The search strategy was conducted within 10 academic electronic databases of Cochrane Library, Cumulated Index in Nursing and Allied Health Literature (CINAHL), Emcare Nursing and Allied Health Database (Emcare), Excerota Medica Database (Embase), Maternity and Infant Care Database, Medline, OVID, ProQuest, PubMed and SCOPUS. In addition, clinical trial ($n = 3$) and systematic literature review registries ($n = 2$) were also searched using the above strategy. The search strategy included studies published in the English language from the inception of the database or registry to May 2025.

After a comprehensive search of specified academic electronic databases was completed, studies were screened using Covidence and duplicates removed [28]. Risk of bias was evaluated using the Cochrane Risk of Bias Tool, which assesses studies for validity based on sequence generation, allocation concealment, blinding of participants, personnel and outcome assessors, incomplete outcome data, and selective outcome reporting [29]. All studies were evaluated by 2 blinded reviewers by title and abstract, any conflicts were resolved by consensus with a third reviewer.

3.2 | Study Selection

Study selection was based on the following criteria: use of a randomised controlled trial design comparing 2% lignocaine versus a water-soluble lubricant during urethral catheterisation in women aged 16 years and older, with the primary outcome measure of procedural pain evaluated using a 0–100 mm visual analogue scale (VAS). Studies examining suprapubic or intermittent catheterisation, or urethral catheterisation in women during cystoscopy or urodynamic procedures were excluded.

3.3 | Quality and Bias Assessment

Included studies were appraised using the Cochrane Risk of Bias 2.0 for Randomised Controlled Trials [29]. Risk of bias was assessed by two independent reviewers using Covidence, and consensus was reached on discrepancies through discussion. Risk of bias was assessed against the following domains: randomisation process, intervention deviation, missing outcome data, outcome measurement and selective outcome reporting. Each domain was judged as either high, some concerns or low with an overall study rating of bias.

3.4 | Data Extraction and Analysis

Data extraction was undertaken by the reviewers manually and using Covidence. Items of data extraction included: aim, study design, setting, sample size and characteristics, intervention and control, outcome measures and results. Meta-analysis was undertaken by using Review Manager [30]. Data from selected studies were combined with Review Manager using a fixed-effects model. If standard deviations were not available in a report, they were imputed using mean and confidence intervals [31]. Heterogeneity for each outcome was estimated using the I^2 statistic. Due to the small number of studies no method was used to investigate the impact that differences in urinary catheter size, duration or volume of lubricant applied had on the pooled treatment effect.

4 | Results

A search of 10 databases and five registries yielded 2813 results. After removing 783 duplicates, 2030 (72.2%) unique items remained, each of which was screened for eligibility independently by two blinded reviewers; 2014 items were excluded for lack of relevance based on their title and abstract. After screening the references of the texts included in the systematic review, 16 (0.6%) were selected for full text review. Following completion of the full text review, 3 studies were included in the systematic review (Figure 1).

4.1 | Study Characteristics

Characteristics and results of the included studies are reported in Table 1. Trials were conducted in Australia ($n=2$) [32, 33] and Singapore ($n=1$) [34]. The three RCTs had a total of 214 female participants with a mean age of 66.9 years (range 18–101 years). Participants were recruited from medical wards [34] or the emergency department [32, 33]. Urethral catheterisation was based upon medical assessment. All studies assessed pain prior to and on completion of urinary catheterisation using VAS (0–100 mm). Of the studies included in the review, the size of catheter used ranged from 8Fr to 14Fr. In the study conducted by Tanabe et al., a size 8Fr was used if a specimen sample, with a size 16Fr if continuous collection was needed. A post hoc analysis was then conducted to examine the impact of catheter size (8Fr vs. 16Fr), age and diagnosis of urinary tract infection and procedural pain [33]. In the study conducted by Chung et al., the protocol requested that a size 14Fr catheter was to be used whenever possible. Of the three studies included in the review, only two ($n=114$) reported the actual catheter sizes used, with the most common being 14Fr ($n=61$, 53.5%) or 12Fr ($n=52$, 45.6%) [32, 34].

4.2 | Quality and Bias Assessment

All studies were rated as having a low risk of bias (Figure 2) [29, 35]. Participants were evenly allocated into either the intervention or control group by pulling a random number from an envelope [33] or randomly ordered identical study packs that contained the study lubricant [32]. Nursing staff performing the urethral catheterisation and patients were blinded to the type of lubricant used. No study reported deviation from the study protocol, with pain assessed immediately prior to and within 10 min of completing the procedure using the VAS.

4.3 | Outcome Measure

The primary outcome measure for all three studies was pain intensity. Pain was evaluated using the Visual Analogue Scale (VAS) for pain, a visual scale 100 mm in length anchored at each end: 'no discomfort or pain' and 'worst ever discomfort or pain'. Measurement of pain occurred prior to catheterisation and no more than 10 min after the procedure was completed. Mean and median pain scores were reported. Two studies reported on the number of insertion attempts [32, 34], with most ($n=93/114$, 81.6%) nurses able to successfully pass the catheter on the first try. Additionally, post hoc analysis was conducted in one study to investigate age, diagnosis of urinary tract infection and catheter size on procedural pain [33].

4.4 | Data Analysis

Of the three studies, Chan et al. [34] and Chung et al. [32] analysed the VAS pain scores as a continuous variable. In contrast, Tanabe et al. [33] categorised patients' pain scores into two groups: low pain (VAS≤39) and moderate to severe (VAS=40–100) without providing a rationalisation for the binary cut-off. Categorising the VAS score alters study power and could account for the difference in the findings. Heterogeneity was moderate to substantial ($I^2=61\%$; χ^2 5.18 df=2; $p=0.08$), and a fixed-effect model was used. The pooled results indicated that there is a statistically significant difference between the intervention and control groups (mean difference −10.81, 95% CI: −15.81 to −5.35) (Figure 3).

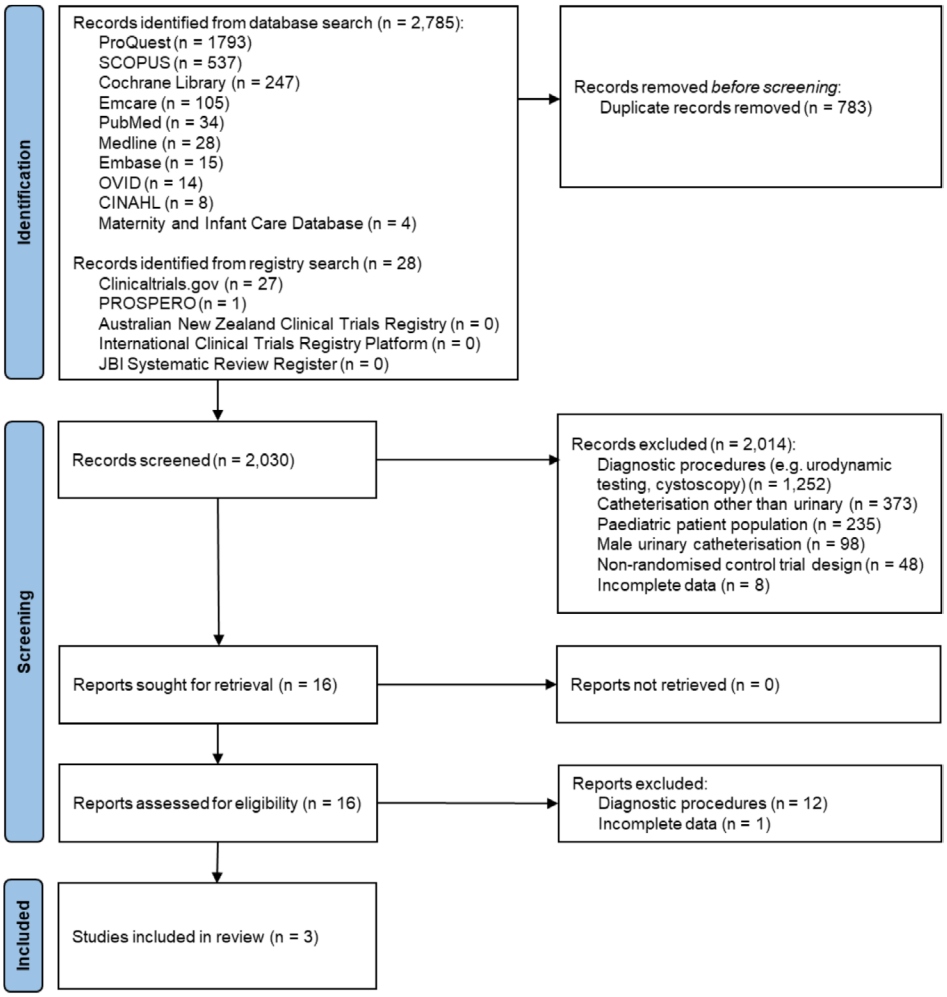

FIGURE 1 | PRISMA flow diagram of included studies.

5 | Discussion

Our study reports 2% lignocaine gel is more effective in reducing catheterisation-associated pain in women compared to a water-based gel lubricant. In this systematic review, studies were powered to detect different effect sizes (10 mm [32] and 26 mm [34]) or used a minimum clinically important difference (20–35 mm [33]) which affects the likelihood of detecting significant differences (i.e., responsiveness) [36]. In a recent systematic review (15 studies, $n = 3109$) conducted by Olsen et al. [37], the minimum clinically important difference (MCID) threshold of VAS acute pain scores was reported to be 16 mm (IQR 13 mm–19 mm; I^2 91%). However, one study noted that the MCID in VAS acute pain scores was higher in men compared to women ($n = 48$, 21.5 mm, 95% CI: 17.3 mm–25.7 mm vs. $n = 29$, 9.1 mm, 95% CI: 3.9 mm–14.3 mm; $p < 0.0001$, respectively) [38]. While the MCID in VAS pain scores can vary by population and context [39, 40], they may mask clinically important differences in women. Interestingly, numerous studies of more invasive procedures such as cystoscopy, report the use of lignocaine gel and oral analgesia [41–44]. Of the three available studies, the VAS was inconsistently analysed which may have influenced the reported outcome. Although we acknowledge that invasive procedures necessitate the use of analgesia, the assumption that routine urethral catheterisation is not painful or uncomfortable is questionable. To our knowledge, no studies to date have investigated the MCID of VAS in the context of pain in urinary catheterisation.

Despite the prevalence of catheter use among hospitalised women (11% [45] to 40.3% [46, 47]), research on the use of 2% lignocaine gel and analgesic effectiveness in reducing catheterisation-associated pain is limited. Minimal studies have compared the use of lignocaine versus aqueous gel prior to catheterisation of women. Current clinical guidelines recommend water-based lubricants for women but an anaesthetic-based lubricant for men [9–11, 48], highlighting potential gender bias in healthcare. Healthcare professionals' and societies' ingrained perception of gender is attributed to a biased interpretation of clinical symptoms, diagnoses and unequal care [48, 49]. This gender bias in healthcare, particularly concerning the historical exclusion of women from clinical trials and the application of male-centric treatment protocols, has significantly impacted women's health outcomes including in terms of delayed diagnosis and inadequate treatment. Recent studies suggest that gender bias in the treatment of pain is prevalent in healthcare practice [50–54]. Samulowitz et al. [48] suggest men's and women's experience and expressions of pain differ due to biological differences; however andronormativity in healthcare is attributed to

TABLE 1 | Summary table of included studies.

Study, year and country	Study design	Sample characteristics	Intervention	Outcome	Results
Chan et al. [26], Singapore	Single centre, double-blind randomised control trial.	52 female patients ($n=26$ per group) admitted to medical wards requiring urinary catheterisation ($n=23$ intermittent, $n=29$ indwelling). Mean age 67.2 years (SD 13.1 years, range 28–90 years). Catheter size: 10Fr ($n=5$, 9.6%), 12Fr ($n=32$, 61.5%) and 14Fr ($n=15$, 28.8%). Average catheter attempts: 1 ($n=44$, 84.6%, range 1–3)	Intervention group: 2% lignocaine gel, 'usual amount', to coat tip of catheter. Control group: water-based lubricant, amount not specified.	Primary: pain score pre- and post-procedure.	2% lignocaine gel group: pre-procedure (mean) pain score 28.3 mm (SD 27.5 mm) versus post-procedure 8.7 mm (SD 8.3 mm; $Z=-3.80$, $p<0.0001$). Aqueous gel group: pre-procedure pain score 20.6 mm (SD 16.5 mm) versus post-procedure (SD 19.3, 14.2 mm; $Z=-0.36$, $p=0.716$). On comparing post-procedure pain score, a significant difference in the median pain score was observed in the 2% lignocaine gel group ($U=209.5$, $p=0.019$).
Chung et al. [24], Australia	Multi-centre study ($n=2$), double-blind randomised control trial.	62 female patients ($n=31$ per group) admitted to ED requiring urinary catheterisation. Mean age 77 years (SD 14.7 years, range 31–32 years). Catheter size: 12Fr ($n=10$, 16.1%) and 14Fr ($n=51$, 82.3%), unknown ($n=1$, 1.6%). Average catheter attempts: 1 ($n=49$, 79.0%, range 1–3)	Intervention group: 2% lignocaine gel, 'usual amount' to coat tip of catheter. Control group: water-based lubricant, amount not specified.	Primary: Pain score pre- and post-procedure.	2% lignocaine gel group:pre-procedure (mean) pain score 10.0 mm (SD 20.8 mm) versus post-procedure 11.0 mm (SD 30.4 mm). Aqueous gel group:pre-procedure (mean) pain score 11.0 mm (SD 21.5 mm) versus post-procedure 37.0 mm (SD 34.7 mm). Post-procedure pain score was lower in the lignocaine gel group compared to using aqueous gel ($p=0.007$). Majority of urinary catheter placements were successful on the first attempt (79.0%).
Tanabe et al. [25], Australia	Single centre, double-blind randomised control trial.	100 female patients ($n=50$ per group) admitted to ED requiring urinary catheterisation. Mean age 56.4 years (SD 23.4 years, range 18–101 years). Catheter size: 8Fr for specimen collection, 16Fr for continuous collection.	Intervention group: 2% lignocaine, 5 mL, applied for 1 min to meatus. Control group: water-based lubricant, 5 mL, applied for 1 min.	Primary: pain score pre- and post-procedure.	2% lignocaine gel group: mean pain score during catheterisation was 21.9 mm (SD 27.1 mm). Aqueous gel group: pain score during catheterisation was 24.9 mm (SD 30.7 mm). Post hoc binary logistic regression controlling for lubricant group, age, catheter size, preprocedural pain, presence of UTI and ease of insertion found only preprocedural pain level as significant ($p=0.031$, OR 1.02). The insertion of catheters was considered easy (mean difficulty rated 1.64/10, $p=0.56$) Post hoc subgroup analysis found patients aged <60 years reported higher pain scores (29.0 mm vs. 16.0 mm, $p=0.003$) with a mean difference of 14.4 mm (95% CI: 4.3–24.5, $p<0.006$). No differences were found in pain scores between catheter size group ($p=0.9$)

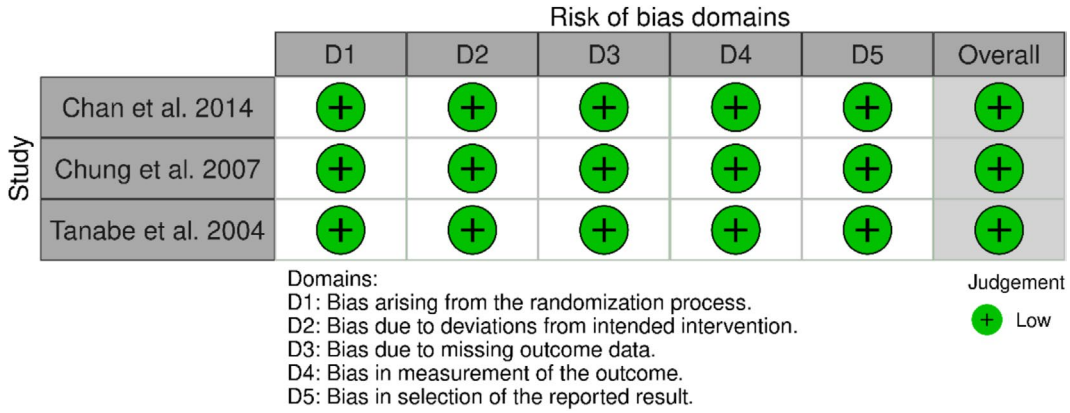

FIGURE 2 | Risk of bias.

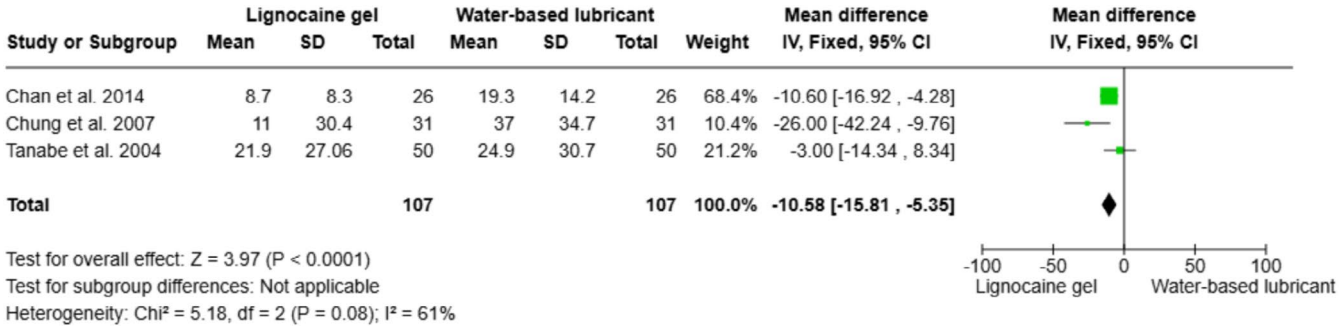

FIGURE 3 | Meta-analysis and forest plot.

healthcare professionals' underexploring and acknowledgement of women's pain.

Gender biases in data collection create a significant gap affecting all levels of health research [55]. The gender data gap occurs when women's perspectives are missing or underrepresented compared to men, and impacts all branches and levels of health research including disease detection, prevention, diagnosis and treatment [56]. Even when women are included in clinical studies, researchers frequently neglect to analyse and report sex-specific outcomes, limiting our understanding of how treatments may differentially affect women and men [48, 50–54, 57]. This oversight can lead to suboptimal or even harmful medical care for women and is evidenced across a range of health conditions presenting in both men and women. Beltz et al. [58], 2019 systematic review found that while many studies include both male and female participants, the majority fail to report whether sex differences are present. Further, an analysis of 192 chronic kidney disease (CKD) trials revealed that women comprised 45% of participants, despite representing 55% of the global CKD population [59]. In addition, sex-disaggregated efficacy and safety outcomes were rarely reported, hindering the identification of sex-specific treatment responses. A further example is in the case of cardiovascular research where, women's pain-related symptoms of myocardial infarction, are often underrepresented or sex-specific analysis is frequently omitted, contributing to late diagnosis and management [60–63].

The androcentric history of healthcare has created a persistent sex and gender gap in health research and treatment [64]. This male-as-default bias affects pain management in women, causing their pain to be underestimated, misdiagnosed, or attributed to psychological factors [65]. Women often face delays in diagnosis and undertreatment of acute pain compared to men [49]. Addressing these gender biases is crucial for equitable person-centred healthcare, such as adequate pain management prior to and during urethral catheterisation. A person-centred approach that considers unique experiences and encourages participation in care is essential [66].

Person centred practice prioritises an individual's unique needs, values and beliefs in all aspects of healthcare delivery emphasising partnerships in care, respect, shared decision making and empowerment [67]. However, gender bias can undermine the effectiveness of person centredness. In our systematic review, 2% lignocaine gel was shown to reduce women's pain, yet current guidelines continue to recommend the use of a water-based gel [2, 9–11, 48]. Although not within the scope of this systematic review, anecdotal evidence suggests that women are not informed or offered the choice of gel products prior to catheterisation. To authentically deliver person centred care, healthcare professionals must be aware of and actively question and challenge gender biases in practice ensuring that all patients receive equitable care regardless of gender identity.

6 | Strengths and Limitations

Regarding the limitations of our study, this review focused on fully published research, which excluded brief reports, congress abstracts and other grey literature. The systematic approach, the homogeneity of participant characteristics within each study,

1:1 randomisation and use of a consistent and validated tool to measure pain strengthen the review. However, the authors acknowledge that the small number of studies, sample size, the use of lubricants, lack of standardisation of the catheter size and varying contexts limit the generalisability and robustness of the study conclusions and clinical recommendations.

7 | Conclusion

Use of 2% lignocaine gel reduces catheterisation pain in women more effectively than water-based lubricant. Despite a lack of evidence, current clinical guidelines recommend the use of a water-based lubricant for women yet an anaesthetic-based lubricant for men. The delivery of authentic person-centred care requires that healthcare professionals challenge gender biases in practice ensuring that all patients receive equitable care regardless of gender identity. The lack of research and the assumption that women do not need the application of a local anaesthetic before catheterisation may be a historical viewpoint and requires further investigation.

Author Contributions

Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data: W.V., J.B., S.S.-L. Involved in drafting the manuscript or revising it critically for important intellectual content: W.V., J.B., S.S.-L. Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content: W.V., J.B., S.S.-L. Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. W.V., J.B., S.S.-L.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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