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PFUI-RELATED COMPLICATIONS
REVIEW

The incidence of erectile dysfunction after pelvic fracture urethral injury: A systematic review and meta-analysis

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KEYWORDS

Erectile dysfunction;
Meta-analysis;
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Urethral disruption;
Pelvic fracture

ABBREVIATIONS

PFUI, pelvic fracture urethral injury;
ED, erectile dysfunction;

Abstract ***Background:*** Pelvic fracture urethral injury (PFUI) is associated with a high risk of erectile dysfunction (ED). The effect of the type of posterior urethral disruption repair on erectile function has not been clearly established. We systematically reviewed and conducted a meta-analysis of the proportion of patients with ED at (i) baseline after pelvic fracture with PFUI, (ii) after immediate primary realignment, and (iii) after delayed urethroplasty.

Methods: Using search terms for primary realignment or urethroplasty and urethral disruption, we systematically reviewed PubMed and EMBASE. A meta-analysis of the proportion of patients with ED was conducted assuming a random-effects model.

Results: Of 734 articles found, 24 met the inclusion criteria. The estimate of the proportion (95% confidence interval) of patients with ED after (i) PFUI was 34 (25–45)%, after (ii) immediate primary realignment was 16 (8–26)%, and after (iii) delayed

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IIEF, International Index of Erectile Function

urethroplasty was an additional 3 (2–5)% more than the 34% after pelvic fracture in this cohort.

Conclusions: After pelvic fracture, 34% of patients had ED. After primary endoscopic alignment, patients had a lower reported rate of ED (16%). Delayed urethroplasty conferred an additional 3% risk above the 34% associated with PFUI alone, with 37% of patients having *de novo* ED. The difference in *de novo* ED after primary endoscopic alignment vs. delayed urethroplasty is probably due to reporting differences in ED and/or patients with less severe injury undergoing primary realignment.

Introduction

The incidence of pelvic fracture urethral injury (PFUI) is estimated at 1.54–10% [1–3]. It is associated with a high incidence of erectile dysfunction (ED) due to traumatic neurogenic, vasculogenic, and direct crural or tunica albuginea injury, resulting in intracorporal fibrosis or venous leakage [4,5]. It is difficult to differentiate between ED due to PFUI and *de novo* ED due to urethral realignment or delayed urethroplasty, unless patients are assessed for ED at several times, ideally before and after injury, as well as before and after repair. Wright et al. [6] showed that PF alone, irrespective of UI, is a risk factor for ED, with a 21% risk. In fact, the urethral injury is probably just a surrogate for severe and localised trauma to the penis and its vascular and neurological inputs.

Researchers often compare the outcomes of primary realignment and delayed urethroplasty for PFUI [7–11]. Outcomes can be biased, as primary realignment might be attempted more frequently and might have greater success rates in men with less severe pelvic and urethral injuries, such as partial urethral disruption [12]. Less information on ED outcomes for primary realignment and delayed urethroplasty is available because most studies focus on resolution of the urethral stricture as the primary outcome. Although some reports compared primary realignment and delayed urethroplasty for PFUI on the outcome of ED [13], most of the studies identified in the present systematic review describe outcomes from one procedure or the other with little synthesis of this information. We sought to examine if one procedure portended better outcomes for ED over the other. The purpose of this study was to systematically review and meta-analyse the proportion of patients with ED (i) at baseline after PF with PFUI, (ii) *de novo* ED after immediate primary realignment, and (iii) after delayed urethroplasty.

Methods

Previously described methods for conducting appropriate systematic review and meta-analyses were followed when constructing the search and synthesising information [14,15]. A medical librarian aided in the selection of the search terms. We used PubMed Medical Subject Headings (MeSH/mh), the Cochrane Database and Embase for the search, with the terms ((‘realignment’) OR (‘alignment’) OR urethra/surgery[mh]) AND (disruption OR injury OR trauma OR distraction) AND (urethra OR urethral)). The search was conducted in May 2012. Pre-determined search-term limits included articles written in the English language, articles from the past 15 years, articles with 10 or more patients, and adult patients. All articles were selected for inclusion and exclusion by two authors, who reached consensus agreement through discussion and review with the other authors. The references for each article were manually searched to assess for any additional articles for inclusion, and expert opinion. ‘Grey articles’ with information from conference proceedings and abstracts were included when using the Embase database search.

Studies were included for meta-analysis if they reported the proportion of patients with ED at one or more of the following times: (i) after injury but before delayed urethroplasty; (ii) after immediate primary realignment; (iii) after delayed urethroplasty. Patients who underwent primary realignment had no assessment of ED after injury and before the realignment procedure, because primary realignment was undertaken within hours to days after injury. A meta-analysis of the proportion of patients with ED was conducted assuming a Freeman-Tukey random-effects model [16].

Methods for primary realignment have changed over time, especially with the introduction of flexible ureteroscopes, the wider availability of fluoroscopic imaging, and the modernisation of endourology equipment. For this reason we limited our examination to studies completed in the last 15 years.

Results

The search identified 914 articles with 637 English language articles. Of the articles identified with the search, 24 reported the proportion of patients with ED at one or more of the times of interest and met the inclusion crite-

ria (Fig. 1). In all, 1534 patients were included in the 24 studies. ED was assessed in a few of these studies [17,18] by the validated International Index of Erectile Function (IIEF) [19,20] questionnaire. However, the remaining studies did not specify the method by which they assessed erectile function.

De novo ED after PFUI

Fourteen studies (total 815 patients) included information on ED after PFUI [17,21–33]. These studies assessed patients who later had a delayed urethroplasty to manage their urethral injury. The pooled estimate of the proportion (95% CI) of patients with ED after PFUI but before delayed urethroplasty was 34 (25–45)%, with a range of ED of 0–100% in these studies (Fig. 2).

De novo ED after immediate urethral primary realignment

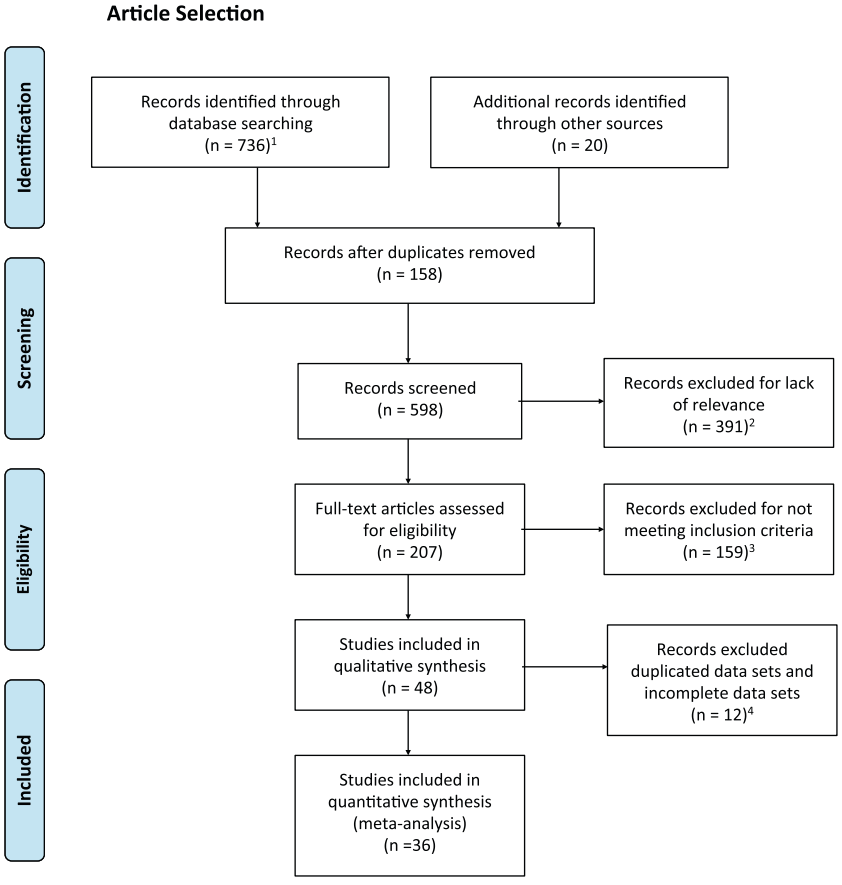
De novo ED after immediate urethral primary realignment was assessed in seven studies, that included 162 patients. In these studies, the proportion of patients with ED after immediate primary realignment was 16 (8–26)% with a range of ED after primary realignment of 0–80%. There was no separate assessment of ED after injury in these studies [12,13,34–38] (Fig. 3).

De novo ED after delayed urethroplasty

In 17 studies, including 1372 patients, ED due to PFUI was assessed, and then *de novo* ED after delayed urethroplasty was assessed [17,21,23–31,39–41]. The proportion of patients with *de novo* ED after delayed urethroplasty was 3 (2–5)%, with a range of *de novo* ED after delayed urethroplasty of 0–34% (Fig. 4).

Discussion

A high percentage of patients with PFUI developed ED. After primary realignment, 16% of patients reported ED, and after delayed urethoplasty 37% of patients reported ED. This percentage takes into account ED reported after PF injury in addition to *de novo* ED after primary realignment or delayed urethroplasty. PF injuries can result in ED due to associated vascular, neurological



1. Articles from sources: PubMed 236, Embase 483, Google 17
2. Not about urethroplasties or ED
3. Case report 9, editorial comment 34, review article 15, children 19, <9 patients 3, PFUDD 63, Posterior urethroplasty 16
4. Duplicated data sets 5, Data sets missing outcome information 7

Figure 1 The inclusion and exclusion of articles in the systematic review.

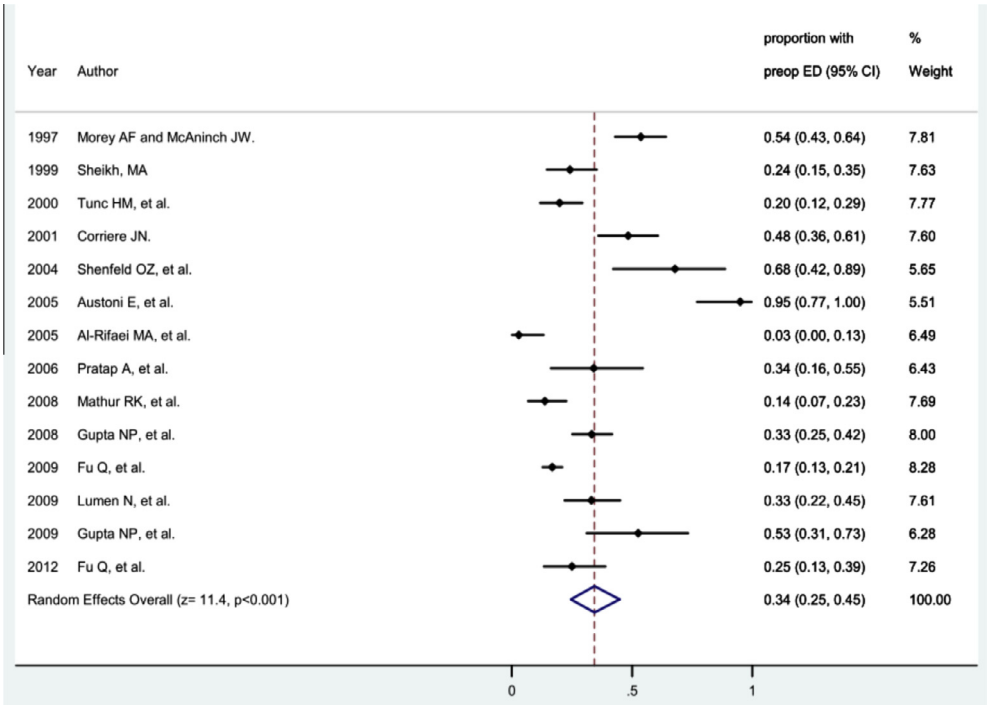


Figure 2 The proportion of patients with PF injury who had ED before intervention.

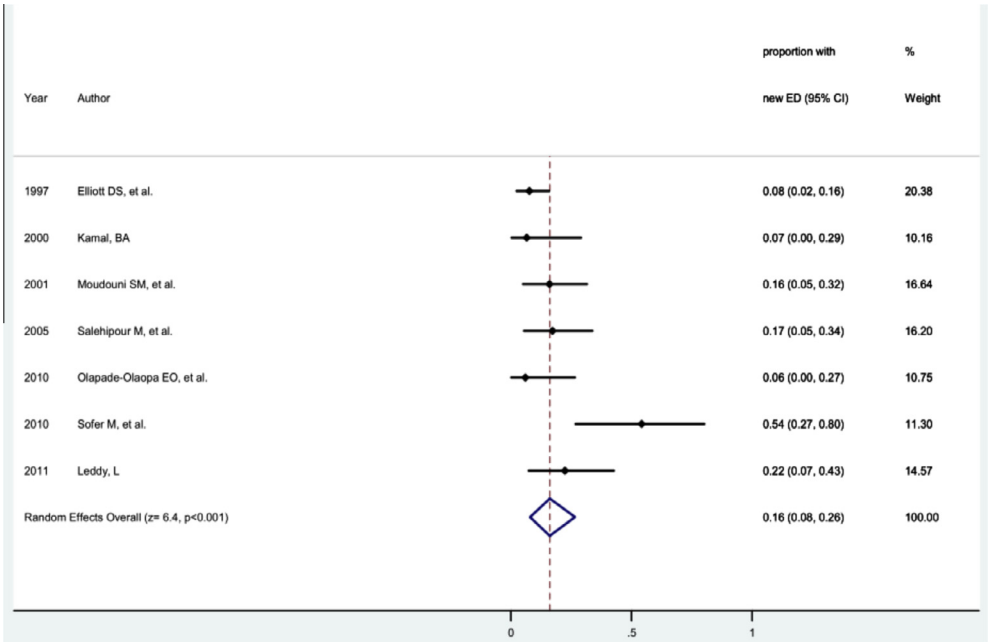


Figure 3 The proportion of patients undergoing primary realignment and with *de novo* ED.

or corporal injuries. Both PF injuries (with or without UI) and urethral repair have been associated with ED [6]. An increasing focus has been placed on evaluating ED after urethroplasty and on methods of preventing *de novo* ED [41,42].

The analysis of *de novo* ED after delayed urethroplasty is clearer than in patients who underwent primary realignment, because ED was assessed both after PF injury and after urethroplasty. That 34% of men sustaining a PFUI and developing ED highlights the vascular and neurological injuries sustained during pelvic fracture.

On initial examination of these results, it might be argued that primary realignment is the best option to preserve erectile function in men who sustain a PFUI. Primary realignment might result in a lower rate of

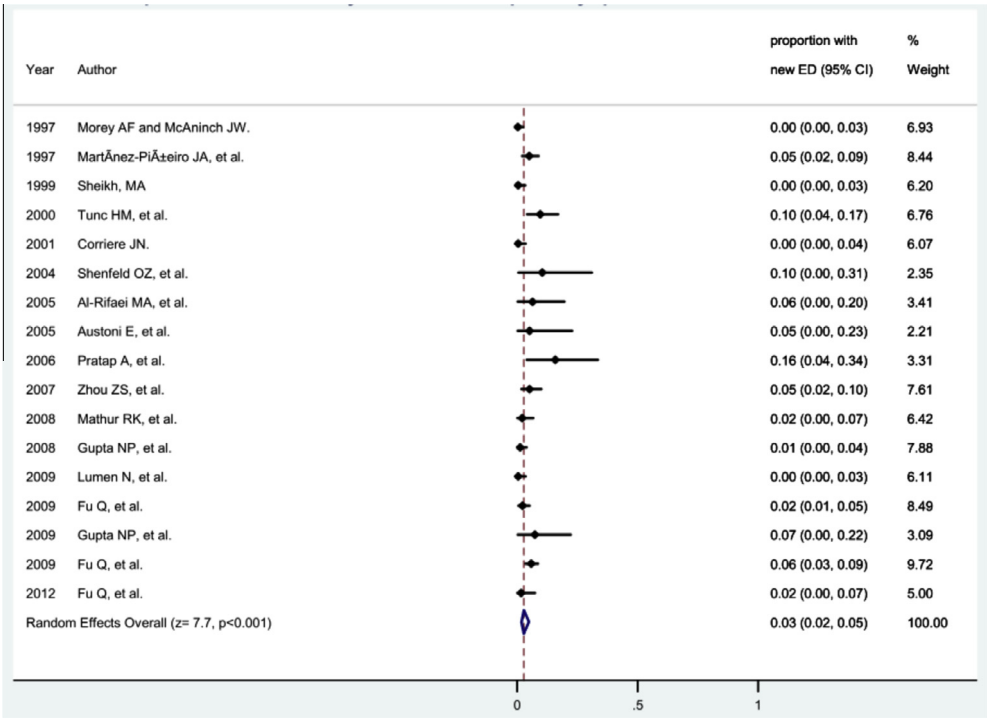


Figure 4 The proportion of patients undergoing delayed urethroplasty with *de novo* ED. This proportion takes into account ED occurring after PF injury and shows only additional *de novo* ED after delayed urethroplasty.

ED than delayed urethroplasty. However, there is no way to assess ED due to the PF injury itself in these patients, vs. ED attributable to the primary realignment procedure, as *de novo* ED was assessed after the realignment procedure.

The incidence of *de novo* ED in the primary realignment and delayed urethroplasty groups might serve as a surrogate marker for the severity of PFUI between men in the two groups. That 34% of men in the delayed urethroplasty group developed ED after PF injury alone but before urethroplasty, compared with 16% of men in the primary realignment group, suggests that men able to undergo primary realignment have less severe PFUIs than men who undergo delayed reconstruction with urethroplasty. This is in line with a previous small study by Kotkin et al. [43], who reported a 24% risk of *de novo* ED in patients who underwent immediate realignment after PFUI. However, this association is not clear, as some institutions might only perform delayed urethroplasty procedures and not attempt primary realignment.

As in all systematic reviews and meta-analyses, the primary limitation is the quality of data and amount of detail provided in each of the included studies. Most studies did not specify the method by which erectile function was assessed for these patients. Some studies might have relied upon patient self-reporting of ED, which could have resulted in an underestimate of ED. As erectile function was not assessed after injury but before primary realignment, it is difficult to assess how much ED is attributed to the injury itself rather than the primary realignment. Future studies of erectile function after PFUI should include prospectively collected data with a validated survey instrument.

Conclusions

After delayed urethroplasty only a small proportion of additional patients had *de novo* ED unrelated to their initial PF injury (3%). After primary endoscopic alignment, patients had a lower reported rate of ED (16%) than patients with PF before (34%) and after (37%) delayed urethroplasty repair. These differences in ED between patients treated with delayed urethroplasty and primary realignment are probably due to lack of an assessment of ED after injury and before realignment in primary realignment, and a bias whereby patients with less severe urethral injury undergo primary realignment. Further research is needed to prospectively measure the sexual and urinary outcomes after PF and before surgical intervention, in addition to after intervention, using standardised variables such as the IIEF questionnaire, and stratifying PFs according to the Orthopaedic Trauma Association classification. This will help to determine the best therapeutic approach in managing this potentially debilitating injury.

Conflict of interest

None.

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