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Welcome to the Stone Age: minimally invasive treatments for urolithiasis

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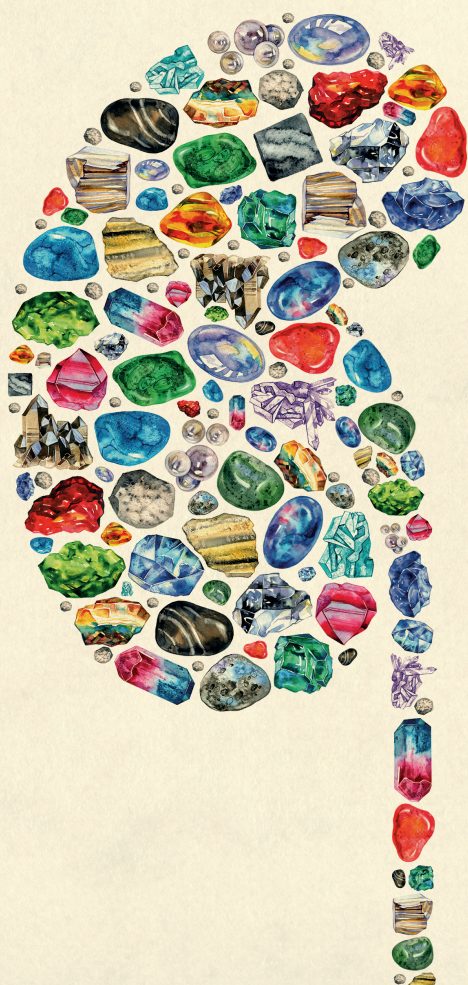
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PCN versus JJ – A systematic review

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ABSTRACT

Purpose

To review the literature on optimal methods of drainage for obstructive urolithiasis in adult patients, comparing percutaneous nephrostomy (PCN) to retrograde ureteral catheterization (JJ) regarding success of procedure, efficacy, complications, quality of life (QOL) and costs.

Methods

Web of Science and the Medline, Embase, Emcare and Cochrane controlled trial databases were searched for all relevant publications until November 2018. A review protocol was created, using the PRISMA-statement. Two reviewers independently screened the titles and abstracts in Endnote X8, using criteria as stated in the research protocol. A total of 1108 abstracts were screened of which nine were included in the qualitative synthesis. Level of evidence of the studied articles varies between 1b and 2c.

Results

Both JJ and PCN have high success rates (80-100% and 99-100% respectively). No major complications were reported in both groups. Procedural and fluoroscopy times are significantly shorter for JJ compared with PCN (31-33 minutes vs 35-49 minutes and 5 minutes vs 7 minutes respectively). Time to clinical improvement did not differ. In the JJ group analgesics were used more frequently than in the PCN group. Data regarding procedural costs were contradictory, but overall the PCN group was associated with higher costs. In pregnant women, PCN placement appears to be significantly more successful than placement of JJ. A significant decrease between pre- and post-intervention quality of life was found with patients receiving a JJ. Back pain was reported more frequently in the PCN group; urinary symptoms were more common in the patients with a JJ.

Conclusions

Both PCN and JJ have comparable success rates for patients with obstructive urolithiasis and procedure related complications are rare. Overall, higher rates of sepsis, longer hospital stay and higher costs were found in the PCN group, but that could be explained by patient selection. Patients with JJ experienced a lower quality of life and experience more lower urinary tract symptoms (LUTS).

INTRODUCTION

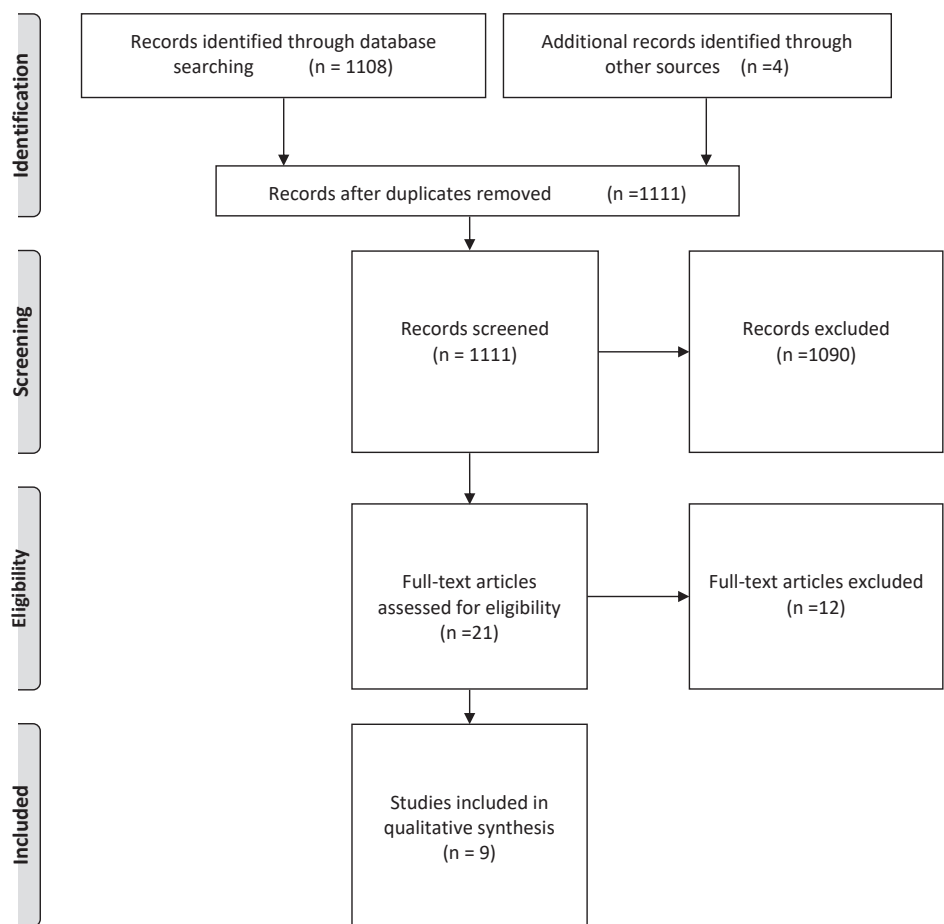
Drainage of the urinary tract is necessary when obstruction of the upper urinary tract causes infection, loss of renal function or uncontrollable pain. Untreated obstruction in patients with infection may induce significant morbidity such as sepsis, pyonephrosis and death [1]. Decompression of the urinary tract can be realized by retrograde or antegrade route. Most methods used are either percutaneous nephrostomy (PCN) or ureteral catheterization or stenting (JJ) [2].

Both procedures have pros and cons concerning complications, costs, quality of life and further treatment. However, for some patients timing is essential and may influence the choice of treatment[3]. EAU guidelines recommend PCN as well as retrograde JJ insertion for adequate decompression[4]. It is recommended that local expertise and resources should guide this choice.

The recommendation in the EAU guideline of 2018 is based on a review of data up till 2010. More than eight years later, the optimal method of decompressing the upper urinary tract is still a topic of discussion. High quality data on this subject are rare. In this review we aim to give a complete overview of available data on both drainage methods concerning success, efficacy, complications, costs and quality of life.

METHODS

A review protocol was created, using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)-statement. A search was performed in November 2018, using PubMed, Embase, Web of Science, Wiley/Cochrane Library and Emcare. Search terms: urolithiasis, nephrolithiasis, calculi, stones, drainage, nephrostomy, JJ, stent, decompression, obstruction, ureteral, hydronephrosis, dilatation, acute and costs were used and filters [human] and [English] were applied. No date restrictions were applied. Two reviewers (S.W. and B.S.) independently screened the titles and abstracts in Endnote (EndNote X8; Thomson Reuters, Philadelphia, PA, USA), using the criteria as stated in the protocol on PROSPERO. The full text of all potentially eligible publications was independently screened using a standardized screening form. Reasons to exclude articles were: inclusions of patients with malignancy as a cause for obstruction, no comparison between PCN versus JJ or describing only technical aspects and no outcomes. A third reviewer (R.P.) resolved any disagreements between the two reviewers.



A. PRISMA flow chart of inclusion

The different types of interventions were insertion of PCN or that of a JJ. This review addresses drainage of obstruction by stones in the kidney or ureter. Excluded were children and patients with renal transplantation. Also, case series including less than 10 patients, case reports and meeting abstracts were excluded. No date restrictions were applied. Duplicates were removed. Relevant reviews were screened for additional articles to be included. The Cochrane Risk of bias Assessment Tool was used to perform a risk of bias analysis for included nonrandomized comparative studies. Studies were assessed according to risk of selection, performance, detection, attrition and reporting bias, and were graded as low, high or unclear. A PRISMA flow chart of our search is included (A).

A total of nine articles were included in the final review. Level of evidence of the used articles varies between 1b and 2c. The data table is included (B). The complete search string is shown at the end of the article (C).

RESULTS

Of all included articles, most patients experienced infection as the main cause for decompression of the urinary tract. An overview is given in the data table (B).

The need for drainage and choice of procedure

Since patients in only three out of the nine articles included were randomized, a choice for either JJ or PCN was made in the other six studies. When time from randomization to drainage procedure was reported, no significant difference was found between the PCN and JJ group [5].

Overall, patients in the PCN group had larger stones compared to the JJ group; in the study of Goldsmith(7) stones had a median size of ten mm in PCN versus seven mm in the JJ group ($p=0.031$); in the study of Yoshimura(8) a mean stone size of 9.7 mm in the PCN versus 2.6 mm in the JJ group ($p=0.006$). Also stone burden was significantly higher in the study of de Sousa[6] in the PCN (median 92 mm²) compared to the JJ group (median 47 mm², $p=0.012$). Stone location did not differ[7, 8].

Compared to patients receiving JJ, patients in the PCN group appeared to be more severely ill with higher APACHE scores[7]. A large retrospective data analysis from the USA amongst 396.385 patients with urolithiasis and associated infection showed that with emergency decompression most of the time JJ was chosen (87.7%). A PCN was more likely to be placed at large urban teaching centres and males were significantly more often treated with PCN compared to females [9]. When requiring emergency drainage, more additional interventions and a longer hospital stay was necessary compared to patients with urolithiasis without need for emergency drainage[8].

Technical aspects; success and complications

Five studies described the type of anaesthesia used when intervention took place. In 4 out of these, placement of both PCN and JJ were performed under local anaesthesia. During procedures, analgesics were used more frequently in the JJ group compared to PCN ($p=0.061$) [10]. Fluoroscopic guidance was used in most procedures. Most commonly 8-14 French nephrostomy tubes and 4.5-7 French JJ were used. Location to perform the procedures varied from operating theatre (most frequent) to angiography

suite or the urology outpatient department. Concerning procedural and fluoroscopy times, two randomized studies showed significantly shorter times for JJ compared to PCN insertion ($P<0,05$)[5, 11]. PCN insertion was successful in 95-100% and introduction of JJ in 80-100% of the procedures. JJ failure occurred more frequently in patients with high ureteral stones and age above 60 years [10]. When either procedure failed, the other procedure was performed in a second attempt [5, 7, 10, 12, 13].

Besides failing procedure, complications were rare. Dislocation of nephrostomy occurred in one patient in the nephrostomy group [11]. One study reported that antibiotics were administered for more than five days in 64% of patients in the JJ versus 0% in the PCN group[10]. However, a large epidemiological study reported in matched analysis the rates of sepsis and morbidity were significantly higher in the PCN group compared to JJ placement [9]. In the recent study of de Sousa no significant difference for need of antibiotics and urinary infections was found[6].

Efficacy, length of stay and costs

Two of the randomized studies showed that clinical improvement and normalization of index parameters such as white blood count and body temperature were not different between groups[5, 11]. One other study stated that patients in the JJ group had more rapid progression of inflammation and more severe thrombocytopenia. Peak CRP and WBC however did not differ between groups[8].

Difference in length of hospital stay was not different in one of the randomized studies (4.5 days in PCN vs. 3.2 days in JJ group) [5]. But two other studies reported significant longer hospital stay ($p=0.001$) and higher rates of Intensive Care Unit (ICU) admission ($p=0.016$) for the PCN group[7]. When matched analysis was performed in a large demographic study from the USA, higher rates of sepsis, severe sepsis, prolonged length of hospital stay, elevated hospital charges and mortality for patients in the PCN group were found. When comparing JJ and PCN within subsets (pyelonephritis versus cystitis, elective versus urgent) these differences were also found[9]. Yoshimura showed that hospital stay was ten days longer in patients undergoing immediate drainage compared to other urolithiasis patients[8].

In one of the randomized studies costs of JJ insertion was twice as high (\$2401) as PCN (\$1137)[5]. Large demographic data analysis for elevated hospital charges (beyond the 75th percentile of \$28 245) showed significant differences between groups, favouring the JJ group for lowest costs (26.5% versus 46.3%, $p<0.001$).

Drainage during pregnancy

Two retrospective studies described the treatment of obstruction due to urolithiasis during pregnancy. The indication for intervention varied from loss of renal function, infection and pain to positive urine culture. PCN and JJ but also ureterorenoscopy (URS) were chosen as first treatment option. Both PCN placement and JJ insertion were carried out under local anaesthesia. PCN was successful in 100% and complications were reported in 31.2%. Besides skin infection also pain was accounted for as a complication. JJ placement was successful in 71%-89%. Failure of JJ placement occurred more frequently in patients with stones larger than 2 cm. Complications were reported more frequently in the JJ group (52.9%), comprising pain, bladder irritation, but also an encrusted JJ and preterm labour. JJ replacement was needed twice for uncontrollable infection and stent migration. Procedural time, costs and length of hospital stay were significantly different, favouring the JJ group ($p < 0.001$). Both PCN and JJ were reported to be uncomfortable. All patients underwent successful delivery [12] [13].

Quality of life

Of our nine selected articles, five described QoL as study outcome. Anaesthesia and analgesics did not only influence success of a procedure, but also patients' quality of life [14, 15].

Back pain was frequently reported and was more present in the PCN compared to the JJ group ($P < 0.05$) [5, 11]. A difference in the use of analgesics was not reported and duration of pain was comparable. Another randomized study did report more frequent use of analgesics in the JJ group compared to the patients in the PCN group [10]. Urinary symptoms such as haematuria were more common in patients with a JJ (68.7%) compared to PCN (16.7%, $p < 0.001$). Also, dysuria was reported significant more frequently in the JJ vs the PCN group (78.3% vs 16.7%, $p < 0.001$).

A significant decrease was found between pre- and post-intervention quality of life (QoL) in patients receiving JJ ($p < 0.001$), but not in the PCN group ($P = 0.206$) [6]. Quality of life reduction was also found to be more prominent in the JJ group of a randomized study, especially in males and patients < 40 years of age. However, these results were not significant [10].

Spontaneous stone passage and stone management

Spontaneous stone passage was described in 2 studies and both presented no significant difference between the groups. One showed similar rates of passage between JJ and PCN group (12-14%, $p = 0.786$). The most recent article with spontaneous stone passage

TABLE B. Included studies in order of clinical relevance and then year of publication. An overview of study patients and methods

Study	Study design (level of evidence)	Gender distribution (M:F)	Mean age in years (range or SD)	N total (PCN/JJ)	Reason for drainage	Inclusion criteria	Primary outcome
Pearle et al 1998	Randomized controlled trial (1b) 1995-1997	PCN group: (8:13) JJ group: (10:11) P value not significant	PCN group: 41.3 (+/- 13) JJ group: 41.3 (+/- 14.5)	42 (21/21)	- infection	Obstructing ureteral calculi + clinical signs of infection * *T>38C and/or white blood count (WBC) > 17,000/mm	Time to normalization of WBC or temperature
Mokhmajji et al 2001	Randomized prospective study (1b) 1996-1998	PCN group: (12:8) JJ group: (9:11) Comparable groups	PCN group: 55 (24-78) JJ group: 49 (24 - 76) Comparable groups	40 (20/20)	- infection - pain - loss of renal function	Hydronephrosis caused by urolithiasis and: Renal colic or T>38 or stone > 15 mm or urosepsis or creatinin increase or UTI and incipient sepsis in blood count	Course of procedure, subsequent progress and quality of life (QoL)
Rammohan et al 2015	Randomized prospective study (1b) 2012-2014	PCN group: (8:12) JJ group: (9:11) P value not significant	Overall 46.47 (+/- 9.36)	40 (20/20)	- infection	Obstructing ureteral or renal pelvic stones with clinical signs of infection* *fever, WBC elevated	Time to normalization WBC, normalization of temperature, resolution of pyuria if seen
Sammon et al 2013	Observational cohort (2b) 1999-2009	PCN group: (35:65) JJ group: (28:72) P<0.001	PCN group: 53 (40-68) JJ group: 51 (37 - 65) P<0.001	396.385 (13,967 / 99,492)	- infection	Adult patients hospitalized with infected urolithiasis	Sepsis, organ failure, mortality length of hospital stay, cost
De Sousa Moraes et al 2018	Prospective cohort (2b) 2017	PCN group: (6:12) JJ group: (19:13) P=0.077	PCN group: 63.1 (+/- 12.5) JJ group: 54.5 (+/- 15.5) P=0.048	50 (18/32) = 36% vs 64%	- infection - pain - loss of renal function	Adult patients with urinary tract obstruction due to kidney stones, confirmed on non-contrast enhanced computed tomography (NCCT)	Spontaneous stone passage (SSP) and quality of life (QoL)

TABLE B. Continued

Study	Study design (level of evidence)	Gender distribution (M:F)	Mean age in years (range or SD)	N total (PCN/JJ)	Reason for drainage	Inclusion criteria	Primary outcome
Yoshimura et al 2005	Retrospective case study (2c) 1994-2003	PCN group: (12:12) JJ group: (12:23) P=0.034	PCN group: 67.3 (+/- 15.7) JJ group: 59.5 (+/- 17.4) P=0.042	59 (24/35) = 41% vs 59%	- infection	Patients with urosepsis associated with upper urinary tract and requiring emergency drainage	Course of procedure and subsequent progress
Song Yan et al 2012	Retrospective comparative study (2c) 2001-2012	all pregnant women	PCN group: 26.9 JJ group: 27.2 P=0.973	54 (16/17)	- infection - loss of renal function - pain	Pregnant women who required medical intervention for urolithiasis, diagnosed by creatinine levels/ urine analysis / ultrasound or MRI	Efficacy = success of procedure
Goldsmith et al 2013	Retrospective case study (2c) 1995-2011	NR	56 (19-88)	130 (59/71) = 45% vs 55%	- infection	CT diagnosis of obstructive urolithiasis and 2/4 SIRS criteria (T / HR / RR / WBC)	Stone related and clinical variables which predicted use of each treatment method APACHE/ BMI / CCI / age etc)
Wang et al 2014	Retrospective comparative study (2c) 2006 - 2012	pregnant women	26 (17-39)	87 (4 / 19) Ureterolithotripsy (n=64)	- infection - loss of renal function - pain	Pregnant women who were treated with invasive procedures for proximal symptomatic ureteral stones between 2006-2012	Success

NR = not reported

SIRS = Systemic inflammatory response syndrome

as a primary outcome reported spontaneous passage in 25% of JJ patients compared to 38.9% in the PCN group ($p=0.304$)[6]. Evidence of impact of the type of intervention on stone passage was not found on univariate analysis in this last study, but after adjusting for predictors in multivariate analysis (stone size, previous surgery, medical expulsive therapy and stone site), PCN was associated with significant increase of spontaneous passage (OR 6.667, 95% CI 1.1034-42.970) [6]. In 30.2% of patients ($n=13$) in the JJ group, stones were displaced upwards with retrograde endoscopy[6].

Time to definitive treatment differed between studies and where one of the randomized studies reported a significantly shorter indwelling time of PCN compared to JJs. Another study reported an equal time to treatment of median 30-31 days[7, 10]. Method of drainage correlated with the later treatment method in this last study. Patients receiving PCN were significantly more likely to be treated with a percutaneous approach and patients receiving JJ were significantly more often treated ureteroscopically[7].

DISCUSSION

With this systematic review we aimed to identify the optimal drainage method in patients with obstructive urolithiasis considering the technical aspects of the procedure, efficacy, complications, costs, patient comfort and quality of life.

There are few randomized studies on this subject limited by low inclusion rates. Most studies included focus on infection as the main cause for decompression and do not perform a sub analysis of the groups on indications for drainage: pain, loss of renal function and infection. We aimed to give an overview of the present literature. Since the last review of Ramsey in 2010 six studies were published comparing JJ and PCN for drainage in obstructive urolithiasis[16]. Evaluation of quality of life and the use of patient reported outcome measurements (PROMS) are introduced nowadays in order to assess outcome of procedures from a patient centred view, as shift from a treatment centred view. This is clearly visible in outcome parameters of the more recent studies.

Clinical practice

Preferences for JJ or PCN varied between specialties. A survey amongst radiologists and urologists in 2006 in the UK (response rate of 19.3%) showed that urologists significantly preferred PCN more often than JJ. Only in patients with uncomplicated benign disease and with coagulopathy JJ was the first choice of urologists[3]. Distinction in urgency also appeared to be an important factor in clinical decision-making. In contrast to infection, drainage for pain or loss of renal function may usually be safely delayed for a

limited period of time and logistics can be taken into account. Availability, logistics and experience with PCN or JJ techniques vary during office hours versus on call period, and result in local, regional, national and international differences.

Symptoms and patient selection

Arguments for choosing PCN over JJ were monitoring of diuresis, less manipulation of the urinary tract and the variety of tube sizes for irrigation in a patient with urosepsis. Urinary symptoms such as haematuria and dysuria are reported less frequently in patients with a nephrostomy tube.

Reasons to choose JJ over PCN was the belief of lower rate of complications and no use of external tubes or collecting bags[11]. An external tube and collecting bag are known to give back pain, and is reported more frequently in the nephrostomy group. Also, the risk for congestion and luxation is higher when a nephrostomy tube is present compared to an internal stent.

Patient-specific factors such as anatomic difficulties (BPH / altered lower tract anatomy) and expected definitive treatment may also play an important role in the individual decision-making process, which makes this process difficult to standardize.

A higher risk of bacteraemia during retrograde manipulation was stated previously, but is doubted because of insufficient evidence. Demographic data, using the Nationwide Inpatient Sample of the United States between 1999 and 2009 even supports the opposite[9]. One of our included randomized studies reported this as a secondary outcome and stated there was no significant difference in length of stay or normalizations of infectious parameters[5, 16].

Success and complications

Success of procedure was reached in almost all patients in the JJ and PCN group as well. Since most studies were non-randomized, there has probably been patient selection for choosing either procedure, influencing outcome. In the few cases of either unsuccessful JJ placement or introduction of a nephrostomy, a second attempt crossover to the other procedure was sufficient. Sufficient use of analgesics or anaesthesia could result in better procedural outcome. Most patients in the three randomized studies were treated under local anaesthesia; only Pearle reported JJ placement under general anaesthesia in some cases. Overall success rates in literature for PCN and JJ in patients with obstructive urolithiasis ranged from 98%-100% and 96-100%, respectively[17-19] and are comparable to our review when compensating for low numbers.

Complications in our data were low compared to procedure specific complications reported in literature. Major complication rates for nephrostomy tube placement in urolithiasis patients reached up to 3 to 5% in literature (colon puncture, sepsis, pneumothorax, macroscopic haematuria requiring transfusion) and minor complications were reported up to 4 or 5% (urine extravasation, haematuria and clot retention)[20-23]. In the randomized data included in this review, dislodgement of a nephrostomy tube occurred in one case, but no other complications were seen. Data on retrograde JJ placement in urolithiasis patients showed similar complication rates. The main difference is that these were mostly minor complications. Major haemorrhagic problems or death were not reported for patients receiving JJ[17, 24].

Costs and length of hospital stay

A large variety in outcome was found when evaluating costs. Differences between financial systems of countries and other factors such as materials used, type of anaesthesia, success rates and outpatient versus inpatient procedure make comparison of costs difficult. Length of hospital stay and location of procedure (operating theatre or outpatient department) or use of anaesthesia, are strong influencers of costs. As seen in the article of Pearle, general anaesthesia was used often for JJ placement. Costs were twice as high compared to PCN procedures under local anaesthesia, mainly due to additional costs for using the operating room, extra staff, anaesthesia and supplies. If a hospital provides possibilities for JJ insertion under local anaesthetic in the outpatient department, the comparison would completely be different.

Length of hospital stay can be influenced by a selection bias introduced by the choice of PCN versus JJ. Sammon reported in his retrospective data analysis that patients in the JJ group significantly differed from the PCN group, both patient and hospital characteristics. Patients undergoing PCN experienced significantly higher rates of (severe) sepsis and in-hospital mortality. Also, home healthcare after hospital discharge can take a longer time if PCN was performed and influences total length of stay.

A shorter time to definitive drainage could result in lower costs. A multi-centre analysis in Romania amongst patients with hydronephrosis and infection showed that increased costs of hospital stay were in retrospect significantly related to a longer time to definitive drainage. The group that received drainage within 9 hours of first presentation was associated with the lowest costs and drainage after 15 hours was associated with longer hospital stay and a significant increase in costs [25].

Pregnancy

For pregnant women, two studies were found and concluded that PCN seemed more successful than JJ insertion. Both JJ induced bladder irritation and PCN carrying an external tube or collecting bag were described as uncomfortable. When choosing JJ placement in this group of patients, rapid encrustation needs to be taken into account. During pregnancy, hyperuricosuria, high calcium diet, hypercalciuria and asymptomatic bacteriuria is common, enlarging the chance of complications[26, 27]. With a higher chance of stent replacement, a JJ could be placed in the third trimester of pregnancy[28]. However, in the first and second trimester, a PCN is preferred over a JJ.

Patient reported outcome measurements (PROMS) in urolithiasis

Conclusions on pain and quality of life are contradictory. Back pain was significantly reported more in PCN compared to JJ. Where some opinions opt for a JJ as having greater patient comfort, this burden was considerable. Having a JJ may result in urinary tract symptoms such as dysuria, frequency and haematuria and influence quality of life [6, 10, 29]. Haematuria in literature ranged from 2-21% for patients with JJ and additional analgesia was required in up to 70% of patients in the first week after JJ placement[30, 31]. A solution for this problem could be placement of an antireflux stent, which has proven to reach a higher acceptance rate with significantly less flank pain or pain in the bladder. However costs of these type of stents are higher, which should be taken into account[32].

Age seems to influence quality of life. One of our studies found that patients under 40 years of age appeared to experience more complaints with a JJ than patients above 40 years of age[10]. Also Borofsky reported in his PROMS study that patients <30 years and also between 30 and 65 years of age experienced more stent related side effects compared to patients older than 65[33]. Thus burden of JJ may be greater for younger patients than older patients.

In 2001 Joshi analysed a group of 34 patients in a prospective study comparing PCN with JJ using the EuroQol EQ-5D. Patients in the JJ group had significantly more LUTS compared to the PCN group, but overall analysis showed no significant difference in impact on quality of life[34]. However, intervention specific PROMS regarding decompressing treatments comparing patients with indwelling JJ or nephrostomies have not been developed yet.

CONCLUSION

Both PCN and JJ have comparable success rates for patients with obstructive urolithiasis and procedure related complications are rare. Overall, higher rates of sepsis, longer hospital stay and higher costs were found in the PCN group, but that could be explained by patient selection. Patients with JJ experienced a lower quality of life and experience more LUTS. Selection to date is made by local practice, patient characteristics and expertise as well as facilities. Also, reimbursement may influence preferences. Evaluations of quality of life and PROMS in urolithiasis are gaining ground, but intervention specific PROMS still have to be developed.

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C. OVERVIEW OF THE SEARCH STRATEGY

Search

Reguliere referenties: totaal d.d. 18-6-2018: 997 referenties, afkomstig uit:

PubMed: 675, waarvan 109 nieuw&uniek [RefID/Label 840-948]

Embase: 417, waarvan 9 nieuw&uniek [RefID/Label 949-965]

Web of Science: 463, waarvan 28 nieuw&uniek [RefID/Label 966-997]

COCHRANE Library: 73, waarvan 11 nieuw&uniek [RefID/Label 998-1010]

Emcare: 139, waarvan 11 nieuw&uniek [RefID/Label 1011-1021]

*ontbrekende RefID/Labels betreffen met de hand verwijderde dubbele referenties

Meeting abstract referenties: totaal d.d. 18-6-2018: 401 referenties, afkomstig uit:

Embase: 402, waarvan 56 nieuw&uniek [RefID/Label 346-401]

Web of Science: 2, waarvan 0 uniek

COCHRANE Library: 19, waarvan 0 uniek

Search terms:

("Urolithiasis"[Mesh] OR "urolithiasis"[tw] OR "urinary lithiasis"[tw] OR "Nephrolithiasis"[tw] OR "Kidney Calculi"[tw] OR "Staghorn Calculi"[tw] OR "Ureterolithiasis"[tw] OR "Ureteral Calculi"[tw] OR "Urinary Calculi"[tw] OR "Urinary Bladder Calculi"[tw] OR "Kidney Stones"[tw] OR "Kidney Stone"[tw] OR "Renal Stones"[tw] OR "Renal Stone"[tw] OR "Staghorn Stones"[tw] OR "Staghorn Stone"[tw] OR "Ureteral Stones"[tw] OR "Ureteral Stone"[tw] OR "Urinary Stones"[tw] OR "Urinary Stone"[tw] OR "Bladder Calculi"[tw] OR "Bladder Stones"[tw] OR "Bladder Stone"[tw] OR "Kidney Calculus"[tw] OR "Staghorn Calculus"[tw] OR "Ureteral Calculus"[tw] OR "Urinary Calculus"[tw] OR "Urinary Bladder Calculus"[tw] OR "Bladder Calculus"[tw]) AND ("Drainage"[Mesh:noexp] OR "drainage"[tw] OR drain*[tw] OR "Nephrostomy, Percutaneous"[Mesh] OR "nephrostomy"[tw] OR nephrostom*[tw] OR "Stents"[Mesh:NoExp] OR "stent"[tw] OR "stents"[tw] OR "stenting"[tw] OR "decompression"[tw] OR "double j"[tw] OR "doublej"[tw] OR doublej*[tw]) AND ("intrinsic obstruction"[tw] OR "intrinsic obstructions"[tw] OR "Ureteral Obstruction"[Mesh] OR "Ureteral Obstruction"[tw] OR "Ureteral Obstructions"[tw] OR "Ureteropelvic obstruction"[tw] OR "Ureteropelvic obstructions"[tw] OR "Hydronephrosis"[Mesh] OR "hydronephrosis"[tw] OR "renal dilatation"[tw] OR "kidney dilatation"[tw] OR "renal dilation"[tw] OR "kidney dilation"[tw] OR "acute"[tw] OR ("obstruction"[tw] AND ("ureteral"[tw] OR ureteral*[tw] OR "ureteropelvic"[tw] OR ureteropelvic*[tw]))) NOT (("Case Reports"[ptyp] OR "case report"[ti]) NOT ("Clinical Study"[ptyp] OR "RCT"[ti] OR random*[ti])) NOT ("Animals"[mesh] NOT "Humans"[mesh]) AND (english[la] OR dutch[la]))

