Flexible ureteroscopy for renal stone without preoperative ureteral stenting shows good prognosis

Jiaqiao Zhang [1] , Chuou Xu [2] , Deng He [1] , Yuchao Lu [1] , Henglong Hu [1] , Baolong Qin [1] , Yufeng Wang [1] , Qing Wang [1] , Cong Li [1] , Shaogang Wang [Corresp., 1] , Jihong Liu [1]

[1] Department and Institute of Urology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, People's Republic of China

[2] Department of Radiology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, People's Republic of China

Corresponding Author: Shaogang Wang
Email address: sgwangtjm@163.com

Purpose To clarify the outcome of flexible ureteroscopy for management of renal calculi without preoperative stenting. **Methods** A total of 171 patients who received 176 flexible ureteroscopy procedures for unilateral renal stones were reviewed. All procedures were divided into two groups depending on whether they received ureteral stenting preoperatively. Baseline characteristics of patients, stone burden, operation time, stone free rates, and complications were compared between both groups. **Results** Successful primary access to the renal pelvis was achieved in 104 of 114 (91.2%) patients without preoperative stenting, while all procedures with preoperative stenting (n=62) were successfully performed. A Total of 156 procedures were included for further data analysis (56 procedures in stenting group and 100 in non-stenting group). No significant differences was found regardless of a preoperative stent placement in terms of stone free rate (73.2% with stenting vs. 71.0% without, P=0.854) , operative time (70.4±32.8 with stenting vs 70.2±32.1 without, P=0.969). **Conclusions** Flexible ureteroscopy for management of renal stone without preoperative ureteral stenting are associated with well outcome in short term follow-up. Our study may help patients and doctors to decide if an optional stent is placed or not.

1 **Flexible ureteroscopy for renal stone without preoperative ureteral stenting shows good**

2 **prognosis**

3 Jiaqiao Zhang [a], Chuou Xu [b], Deng He [a], Yuchao Lu [a], Henglong Hu [a], Baolong Qin [a], Yufeng

4 Wang [a], Qing Wang [a], Cong Li [a], Shaogang Wang [a], Jihong Liu [a]

5 **Affiliation:**

6 [a]Department and Institute of Urology, Tongji Hospital, Tongji Medical College, Huazhong

7 University of Science and Technology, Wuhan, Hubei, People's Republic of China

8 [b] Department of Radiology, Tongji Hospital, Tongji Medical College, Huazhong University of

9 Science and Technology, Wuhan ,Hubei, People's Republic of China

10 **Corresponding author:**

11 Shaogang Wang, Department and Institute of Urology, Tongji Hospital, Tongji Medical College,

12 Huazhong University of Science and Technology, 1095 Jiefang Ave., Wuhan 430030, Hubei,

13 People's Republic of China

14 Tel: 86-27-83663460

15 E-mail: sgwangtjm@163.com

16   **Abstract**

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20   renal stones were reviewed. All procedures were divided into two groups depending on whether

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22   operation time, stone free rates, and complications were compared between both groups.

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24   patients without preoperative stenting, while all procedures with preoperative stenting (n=62)

25   were successfully performed. A Total of 156 procedures were included for further data analysis

26   (56 procedures in stenting group and 100 in non-stenting group). No significant differences was

27   found regardless of a preoperative stent placement in terms of stone free rate (73.2% with

28   stenting vs. 71.0% without, P=0.854), operative time (70.4±32.8 with stenting vs 70.2±32.1

29   without, P=0.969).

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31   stenting are associated with well outcome in short term follow-up. Our study may help patients

32   and doctors to decide if an optional stent is placed or not.

Introduction

Improvement of the instruments as well as endoscopic technology has made fURS as an

increasingly popular treatment option for patients with renal stones [1-3]. Indication for fURS

also has been extended, even for stone larger than 2cm [4, 5]. Preoperative stenting is frequently

used to allow passive ureteral dilatation, which is supposed to facilitate the passage of a flexible

ureteroscope or ureteral access sheath (UAS). In a study, double-J stent inserted 5-10 days before

fURS was recommended as a part of standardized technique to achieve superior results for

treatment of renal stones [6]. However, a preoperative stenting inevitably leads extra cost and

time, as well as complications such as flank pain, sexual dysfunction, bothersome urinary

symptoms and potential urinary tract infection [7-9]. Then, patient compliance is an issue for

urologists. In addition, urologists have better skill and more confidence to successfully perform

fURS procedures for patients without preoperative stenting with increased experience. For the

above reasons, more and more fURS procedures without preoperative stenting were carried out in

our department.

However, the outcome of Flexible Ureteroscopic Treatment for renal stones without preoperative

stenting is undefined. Hence, we reviewed a series of cases to seek the answer.

49 **Material and Methods**

50 This study was approved by the ethics committee of Tongji Hospital, Tongji Medical College,

51 Huazhong University of Science and Technology. All unilateral fURS procedures from between

52 June 2013 and May 2015 were reviewed. All patients included underwent fURS as initial attempt

53 or substitute for previous failed ESWL or PCNL procedures to treat solitary as well as multiple

54 renal calculi. The patients with the presence of ipsilateral ureteral stones were excluded. All

55 patients were classified into two groups depending on whether they received a preoperative stent.

56 The patients in stenting group received preoperative stenting (5~8F) for persistent renal colic,

57 fever, insufficient renal function, or just to dilate the ureter to facilitate subsequent fURS. The

58 patients in non-stenting group had not received stenting before fURS.

59 All procedures were performed by experienced urologists in our department according to

60 standard operative protocols. Urinary tract infection was controlled before all operations. For

61 patients with preoperative stenting, firstly the stents was removed through ureteroscopy (URS) or

62 cystoscopy. And for patients without preoperative stenting, a rigid URS was performed to detect

63 the whole ureter at first. Then a guidewire was inserted into ureter and UAS (12/14F, Cook) was

64 placed routinely. A 7.5F flexible ureteroscope (Storz, Germany) with a 200μm laser fibre was

65 used for laser lithotripsy. Nitinol stone retrieval baskets were also used if necessary at surgeon

66 discretion. All patients received ureteral stent at the end of operations. Then all patients

67 underwent KUB or non-contrast CT about 4 weeks and 3 months after treatment, and absence of

68 any stone or residual stone fragment ≤4mm was considered as stone free.

69   We retrospectively recorded data from patient documentation, radiologic images (including X-

70   ray, IVU, and computed tomography), reports of anaesthesia and operation. All radiologic images

71   were checked collaboratively by an urologist and a radiologist. Number, location and linear

72   diameter of stones visible in radiologic images were noted in detail. Fever was defined as

73   postoperative body temperature ≥ 38. The procedures were performed by a total of five urologists.

74   Statistical analysis was performed by Statistical Package for the Social science version13.0.

75   Continuous variables with normal distribution and without normal distribution were performed

76   with Student's t-test and Mann-Whitney U-test, respectively. Categorical variables were

77   performed with chi-squared test or Fisher's exact test. Potential factors associated with stone free

78   rate including BMI(kg/m^2), stone size (mm), stone number, presence of preoperative stenting,

79   type of anaesthesia and presence of hydronephrosis were analyzed by multivariate logistic

80   regression analysis. A P value of <0 .05 was considered statistically significant.

81 **Results**

82 A total of 176 unilateral procedures of fURS from 171 individual patients were included. The

83 figure 1 shows the clinical outcome of all patients. Majority (104 of the 114) of the patients

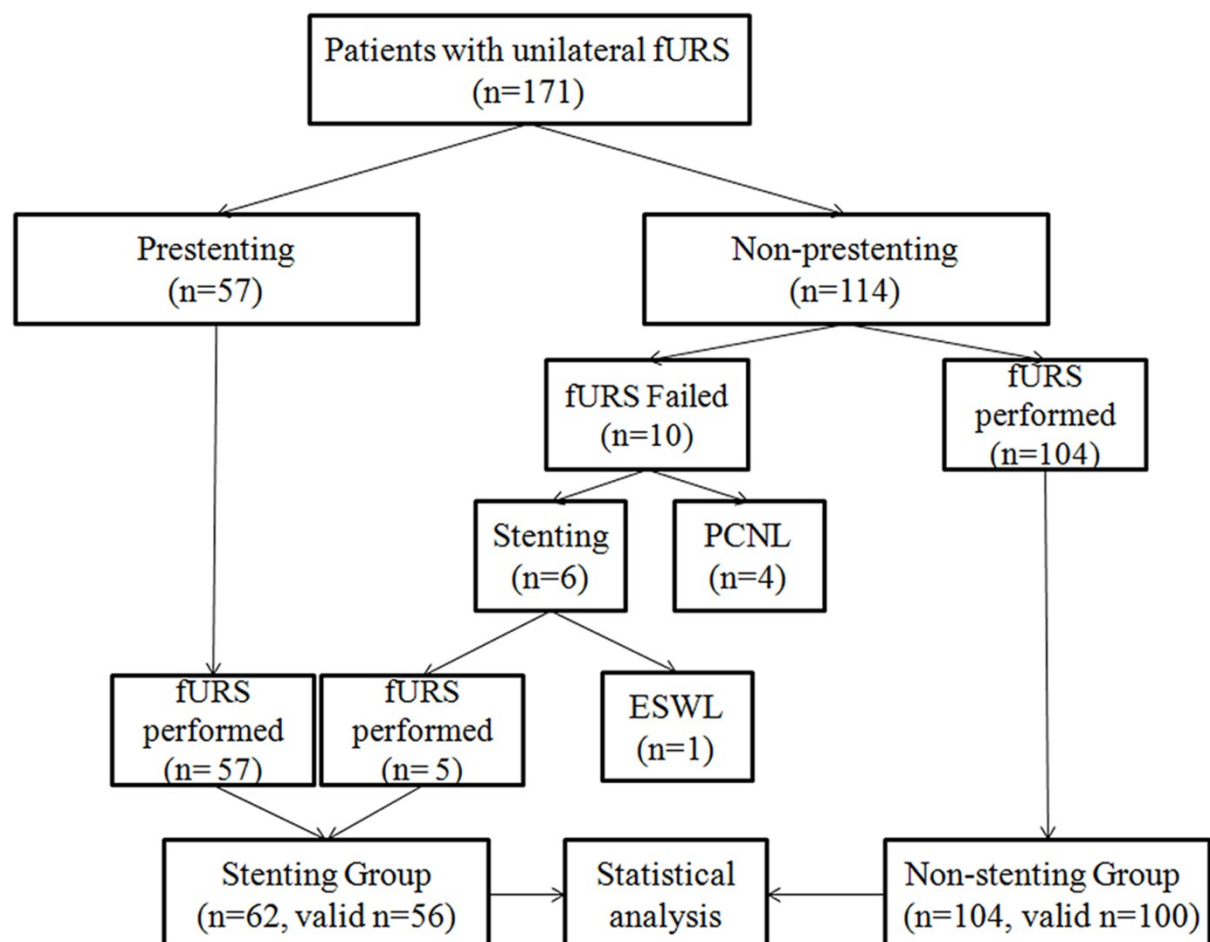
84 without a preoperative stent were successfully performed fURS, while the left 10 patients

85 underwent a failed attempt for access to the renal pelvis was not achieved. Of the 10 patients, five

86 patients received a stent placement and subsquent fURS, 4 patients underwent a conversion to

87 PCNL procedure,and one patient received a stent followed by ESWL treatment. All of 62 patients

88 with a preoperative doule-J stent (including the above mentioned five patients who received a

89 stentin first failed attempt) were successfully performed fURS (figure 1).

90 Figure 1. Flow diagram and patient disposition.(fURS= flexible ureteroscopy; ESWL=

91 Extracorporal shock wave lithotripsy; PCNL= Percutaneous nephrolithotomy)

92 As the figure 1 showed, a tota1 of 166 procedures successfully entered into renal pelvis to

93 perform fURS lithotripsy. Of the 166 procedures, ten procedures with incomplete data were not

94 enrolled for further data analysis. There were no statistically significant differences between

95 preoperative stenting group (n=56) and non-stenting group (n=100) in terms of age, gender, side,

96 BMI, presence of hydronephrosis, type of anaesthesia, operation time. Stone number, stone site,

97 and stone burden were also similar in both groups. Positive rate of preoperative urine culture was

98 higher in stenting group. Stone free rate was similar in both groups. Procedures for solitary stone

99 accounted for 71.2% (111 of 156). For single stone, stone free rate was highest for stone in renal

100 pelvis, and lowest in lower pole. Stone free rates were also similar for patients with solitary stone

101 in both groups (Table 1). Multivariate assessment revealed stone size rather than preoperative

102 stenting was the independent predictor of stone free rate after fURS in this study. (Table 2)

103 Table 1 Patient characteristics in stenting and non-stenting group

	Stenting group	Non-stenting group	P
Procedures	56	100	
Age (year)	51.4±12.8	47.6±13.2	0.080
Gender (Men/Women)	32/24	62/38	0.610
Side (Right/Left)	24/32	47/53	0.738
BMI (kg/m^2)	24.2±3.6	23.7±3.1	0.381
Hydronephrosis(+/-)	20/36	39/61	0.733
Urine culture(+/-)	13/43	7/93	0.006
Anaesthesia (Epidural/General)	30/26	48/52	0.617
Operation time (min)	70.4±32.8	70.2±32.1	0.969
Stone size (mm)	18.1±8.1	18.4±7.7	0.812
<10	7	7	
10-20	29	63	

>20	20	30	
Solitary/multiple stone	40/16	71/29	0.955
Solitary stone location			
Upper pole	3	6	
Middle pole	5	6	
Lower pole	15	29	
Renal pelvis	17	30	
Stone free rate			
	73.2% (41/56)	71.0% (71/100)	0.854
For Solitary stone			
	85.0%(34/40)	77.5%(55/71)	0.458

104 Table 2. Result of multiple logostic regression analysis to determine factors associated with stone
105 free rate.

Varible	Category	OR	95%CI	p value
BMI(kg/m^2)		1.027	0.899-1.173	0.699
Stone size (mm)		0.407	0.206-0.807	0.010
Stone number	1 vs ≥2	0.423	0.147-1.216	0.110
Preoperative stenting	Present vs absent	0.799	0.333-1.919	0.616
Anaesthesia	General vs epi	0.907	0.392-2.101	0.820
Hydronephrosis	Absent vs present	1.070	0.448-2.558	0.879

106 Complication rates were low in both groups except for fever. Surprisingly, up to 17.9% of

107 patients with preoperative stent experienced fever postoperatively. Patients without preoperative

108 stenting had a much lower incidence of fever compared with that (6% vs. 17.9%, $P = 0.027$).

109 Perforations of renal pelvis or ureter were more common for patients without a preoperative stent,

110 and were low in both groups. All perforations were not severe, and treated with a postoperative

111 stent. No complications of ureter avulsion occurred in both groups. Severe complications such as

112 bleeding with transfusion or urosepsis were rare. (Table 3)

113 Table 3 Comparisons of postoperative complications between both groups according to the
114 Clavien-Dindo classification

	Clavien	Stenting group	Non-	p

			stenting group	
Fever	(Grade**II**)	10(17.9%)	6(6%)	0.027
Renal pelvis /Ureter perforation	(Grade **III**b)	1(1.8%)	4(4%)	
Transfusion	(Grade **II**)	1(1.8%)	0	
Urosepsis	(Grade **IV**b)	1(1.8%)	1(1%)	

115 **Disscussion**

116 As one of common available treatment options, fURS has occupied more and more positions

117 formerly held by PCNL and ESWL. However, limited data have been referred to the role of

118 preoperative stenting in the treatment of renal calculi by fURS [10-14]. Shields et al reviewed a

119 cohort of patients undergoing URS for upper urinary tract calculi and concluded that preoperative

120 stent was positively associated with success, however, without statistical significance [11].

121 Lumma et al analyzed data of 550 ureterorenoscopies treated for stones in ureter and renal pelvis.

122 Data indicated that patients with preoperative stent had improved results in stone free rate and

123 complication rate apart from distal ureteral stones [10]. Kawahara et al analyzed 51 patients with

124 large (> 15mm) stone, and concluded that ureteroscopy success rate was higher in the stenting

125 group and may improve SFR [13]. However, most studies were referred to patients with ureteral

126 and renal calculi, and instruments and methods applied for ureteral calculi are quite different

127 from renal calculi. In addition, fURS occasionally will not pass beyond the ureter to reach renal

128 pelvis, which have been mentioned limitedly [15-17]. Therefore, the aim of this study was to

129 systematically clarify the surgical outcome of fURS without preoperative stenting for renal

130 calculi.

131 Of the 114 patients without preoperative stenting, 10 patients underwent a failed procedure for

132   access to the renal pelvis was not achieved. In these patients, a narrow ureteric lumen or tortuous

133   ureter caused the failure of access, even though no evidence of obstruction in ureter was found

134   preoperatively or intraoperatively. Half of the 10 patients received a ureteral stent for a period of

135   time (7~40d) and underwent a second attempt in which narrow ureteric lumen or tortuous ureter

136   disappeared. Obviously, the preoperative stenting passively dilated the ureter and facilitated

137   access to renal pelvis in them. A study by Ambani et al retrospectively analyzed 41 patients who

138   underwent ureteral stenting after an initial failed attempt of fURS. The second fURS was

139   performed in these patients after 4 to 34 days and succeeded in 38 patients (93%) [15]. Therefore,

140   when a difficult ureter was faced in first attempt of fURS, placement of a stent and subsequent

141   second   attempt   was   optional   and   even   encouraged.

142   In our study, stone free rate (3 months after operation) in patients with preoperative stenting was

143   higher compared to patients without preoperative stenting, however without statistical

144   significance (73.2%% vs. 71.0%, *P* =0. 0.854). This result was not consistent with some

145   previously published data [10, 11, 18]. One possible reason was that ureteral stones account for a

146   high proportion of all stones in these studies. Multivariate assessment also revealed that

147   preoperative stent was not the independent predictor of stone free rate after fURS in our study

148   which was similar with a previous study [19]. In our opinion, once the fURS successfully arrived

149   at renal pelvis, stone free rate for renal calculi would be more likely affected by stone

150   characteristics and pelvicalyceal anatomy rather than the existence of preoperative stenting

151   according to our experience and some published data [20-22].

152   Stone free rate was not very high in our study. One reason may be that stone size (18.4±7.7 mm)

153   in our study was higher than many studies [6, 23, 24]. Although non-contrast CT was the most

154   accurate modality for follow-up of urolithiasis, we also performed KUB for follow-up for its

155   advantages of less cost and radiation exposure.

156   The operation time was similar in both groups. However, different results had been reported.

157   Lumma et al found that the operation time in patients with preoperative stent was extended by 4.9

158   min compared to patients without stent, and attributed this to stent extraction [10]. Another study

159   indicated that preoperative stenting decreased operative time of URS for stones (mainly in the

160   ureter). The possible reason may be that preoperative stenting dilated the ureter and allowed a

161   bigger ureteral access sheath and better irrigation [18]. In our experience, it would consume some

162   time to remove preexist stents, however, a procedure of rigid URS was not necessary before

163   placing the UAS in these patients generally.

164   Severe complications were rare in our study, however, postoperative fever rate was much higher

165   compared with other complications. And patients with preoperative stenting had a higher

166   incidence of fever compared with without (17.9% vs. 6.0%, P=0.027). The reason may be that

167   majority of patients with preoperative stenting in this study received a stent just because of

168   existence of fever or urinary tract obstruction and patients in stenting group indeed had a

169   significant higher rate of positive urine culture. So we could not conclude that preoperative

170   stenting increased postoperative fever rate, although an extended time of stenting may cause

171   potential urinary tract infection (UTI) [25]. And the incidence of fever in our patients without

172   preoperative stenting was similar with the results (3.6% for 10-20mm renal stones) of CROES

173 URS Global Study [20].

174 Perforations of ureter or pelvis were not very common in both groups (1.8% with stent vs. 4%

175 without). Actually, as many mild injuries may be ignored in records of our operations, it was hard

176 to know accurate incidence of ureter injuries for all patients. We speculated that ureter injuries

177 (especially for mild injuries) were common according to our experience as well as published data

178 [26]. However, severe ureter injuries such as ureter avulsion never happened. In our experience,

179 if unreasonable resistance was perceived when passing through the ureter, it was better to

180 terminate the fURS procedure rather than try with a greater force to avoid severe ureter injury. As

181 many above mentioned substitutes could be selected subsequently, an "adventure" was not

182 necessary.

183 A recent published large scale study included 1622 patients with renal stones who were treated

184 with fURS and concluded that preoperative stent increased stone free rates (79.6% with stent vs.

185 72.9% without stent) and decreased intraoperative complications [27]. The results of this large

186 scale study are very valuable, however, we still should note that heterogeneity of reasons for

187 preoperative stenting may affect outcome of fURS for renal stones in different studies. And this

188 large scale study indicated that non-stenting fURS for renal stones may have some disadvantages,

189 however, it still had an acceptable prognosis. In addition, it should be emphasized that non-

190 stenting procedures would benefit patients for less cost and suffering.

191 Our study has some limitations. First, it is a retrospective study from single center. Second, the

192   complications mentioned in our study were early stage complications, while late complications

193   such as ureter stricture were not concerned due to limited follow-up time. Despite these facts, our

194   study is one of the largest series to determine the prognosis of non-stenting procedure on

195   management of renal calculi with fURS.

196   Our study showed that majority(91.2%, 104 of the 114) of the patients without preoperative

197   stenting were successfully performed fURS at first attempt. The procedures of Non-stenting

198   fURS for renal stones have an acceptable prognosis compared with the stenting group in our

199   study. If a preoperative stenting is optional, our study may help the patients and clinicians make a

200   final decision. And large prospective randomized controlled studies are required to further figure

201   out the role of pre-stent, especially for optional cases.

References

202

203 [1] Ghani KR, Wolf JS (2015) What is the stone-free rate following flexible ureteroscopy for kidney stones. Nat Rev Urol
204   12:281-288

205 [2] Dauw CA, Simeon L, Alruwaily AF et al (2015) Contemporary practice patterns of flexible ureteroscopy for treating renal
206   stones: Results of a worldwide survey. J Endourol

207 [3] Wang AJ, Preminger GM (2011) Modern applications of ureteroscopy for intrarenal stone disease. Curr Opin Urol 21:141-
208   144

209 [4] Aboumarzouk OM, Monga M, Kata SG et al (2012) Flexible ureteroscopy and laser lithotripsy for stones >2 cm: a
210   systematic review and meta-analysis. J Endourol 26:1257-1263

211 [5] Breda A, Ogunyemi O, Leppert JT et al (2008) Flexible ureteroscopy and laser lithotripsy for single intrarenal stones 2 cm
212   or greater--is this the new frontier. J Urol 179:981-984

213 [6] Miernik A, Wilhelm K, Ardelt PU et al (2012) Standardized flexible ureteroscopic technique to improve stone-free rates.
214   Urology 80:1198-1202

215 [7] Joshi HB, Stainthorpe A, MacDonagh RP et al (2003) Indwelling ureteral stents: evaluation of symptoms, quality of life
216   and utility. J Urol 169:1065-1069; discussion 1069

217 [8] Joshi HB, Stainthorpe A, Keeley FX Jr et al (2001) Indwelling ureteral stents: evaluation of quality of life to aid outcome
218   analysis. J Endourol 15:151-154

219 [9] Shigemura K, Yasufuku T, Yamanaka K et al (2012) How long should double J stent be kept in after ureteroscopic
220   lithotripsy. Urol Res 40:373-376

221 [10] Lumma PP, Schneider P, Strauss A et al (2013) Impact of ureteral stenting prior to ureterorenoscopy on stone-free rates and
222   complications. World J Urol 31:855-859

223 [11] Shields JM, Bird VG, Graves R et al (2009) Impact of preoperative ureteral stenting on outcome of ureteroscopic
224   treatment for urinary lithiasis. J Urol 182:2768-2774

225 [12] Netsch C, Knipper S, Bach T et al (2012) Impact of preoperative ureteral stenting on stone-free rates of ureteroscopy for
226   nephroureterolithiasis: a matched-paired analysis of 286 patients. Urology 80:1214-1219

227 [13] Kawahara T, Ito H, Terao H et al (2012) Preoperative stenting for ureteroscopic lithotripsy for a large renal stone. Int J
228   Urol 19:881-885

229 [14] Rubenstein RA, Zhao LC, Loeb S et al (2007) Prestenting improves ureteroscopic stone-free rates. J Endourol 21:1277-
230   1280

231 [15] Ambani SN, Faerber GJ, Roberts WW et al (2013) Ureteral stents for impassable ureteroscopy. J Endourol 27:549-553

232 [16] Mahajan PM, Padhye AS, Bhave AA et al (2009) Is stenting required before retrograde intrarenal surgery with access
233   sheath. Indian J Urol 25:326-328

234 [17] Cetti RJ, Biers S, Keoghane SR (2011) The difficult ureter: what is the incidence of pre-stenting. Ann R Coll Surg Engl
235   93:31-33

236 [18] Chu L, Sternberg KM, Averch TD (2011) Preoperative stenting decreases operative time and reoperative rates of
237   ureteroscopy. J Endourol 25:751-754

238 [19] Ito H, Sakamaki K, Kawahara T, Terao H, Yasuda K, Kuroda S, Yao M, Kubota Y and Matsuzaki J. Development and
239   internal validation of a nomogram for predicting stone-free status after flexible ureteroscopy for renal stones. BJU Int
240   2015; 115: 446-451.

241 [20] Skolarikos A, Gross AJ, Krebs A et al (2015) Outcomes of Flexible Ureterorenoscopy for Solitary Renal Stones in the
242   CROES URS Global Study. J Urol

243   [21]   Jessen JP, Honeck P, Knoll T et al (2014) Flexible ureterorenoscopy for lower pole stones: influence of the collecting
244   system's anatomy. J Endourol 28:146-151

245   [22]   Resorlu B, Oguz U, Resorlu EB et al (2012) The impact of pelvicaliceal anatomy on the success of retrograde intrarenal
246   surgery in patients with lower pole renal stones. Urology 79:61-66

247   [23]   Perlmutter AE, Talug C, Tarry WF et al (2008) Impact of stone location on success rates of endoscopic lithotripsy for
248   nephrolithiasis. Urology 71:214-217

249   [24]   Hussain M, Acher P, Penev B et al (2011) Redefining the limits of flexible ureterorenoscopy. J Endourol 25:45-49

250   [25]   Shigemura K, Yasufuku T, Yamanaka K et al (2012) How long should double J stent be kept in after ureteroscopic
251   lithotripsy. Urol Res 40:373-376

252   [26]   Traxer O, Thomas A (2013) Prospective evaluation and classification of ureteral wall injuries resulting from insertion of a
253   ureteral access sheath during retrograde intrarenal surgery. J Urol 189:580-584

254   [27]   Assimos D, Crisci A, Culkin D et al (2015) Pre-operative double J stent placement in ureteral and renal stone treatment:
255   results from the Clinical Research Office of Endourological Society URS Global Study. BJU Int