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"R.I.R.S. (RENAL STONE DENSITY, INFERIOR POLE STONE, RENAL INFUNDIBULAR LENGTH, STONE BURDEN) SCORING SYSTEM FOR PREDICTING STONE FREE RATE FOLLOWING RETROGRADE INTRARENAL SURGERY"

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Abstract

Background: This study evaluated the accuracy of the Score: renal stone density, inferior pole stone, renal infundibular length, stone burden (R.I.R.S) scoring system (kidney stone density, inferior pole stones, stone burden, and renal infundibular length) in predicting the stone-free rate (SFR) post RIRS. **Methods**: This retrospective study was conducted in 50 patients aged 18-65 years undergoing RIRS for kidney stones in a tertiary institute hospital from February 2022 to June 2023. Medical records were analysed to obtain the the pre-operative investigations, intra-operative findings and post-operative complications and follow up data. The RIRS parameters were also measured to predict stone free rate post RIRS. **Results**: 38% patients had mild RIRS score (4-5), 60% patients had moderate RIRS score (6-8) and 2% patients had severe RIRS score (9-10). 46 patients (92%) had stone free (SF) status while remaining 4 patients (8%) had residual stone fragments. 22% patients had complications such as fever (18% patients) and urosepsis (4% patients). AUROC for stone burden (mm) and stone density (HU) predicting SF status was 0.989 (p = 0.001) and 0.837 (p = 0.028) respectively. AUROC) for R.I.R.S. Score predicting Complications was 0.8 (p = 0.002) statistically significant. **Conclusion:** R.I.R.S. scoring system was statistically

significant in assessing stone free rate and complications. The higher R.I.R.S. score was associated with more residual stone fragments, lower stone clearance and higher postop complications. Hence R.I.R.S is a reliable and accurate preoperative tool for estimating the probability of stone-free state and complications after RIRS surgery.

Keywords: Scoring system, urolithiasis, stone**,** surgery, postoperative complications

Introduction

Urolithiasis is one of the most common diseases in urology of which the most common form is renal stone. The lifetime prevalence of kidney stone disease is estimated at 1% to 15%, varying according to age, gender, race, and geographic location.[1] The European Association of Urology (EAU) guidelines have recommended procedures like extracorporeal shock wave lithotripsy (SWL), ureteroscopic lithotripsy, retrograde intrarenal surgery (RIRS), and percutaneous nephrolithotomy (PNL) as the first-line interventional therapies for urolithiasis.[2] RIRS is reported to be a safe technique, and associated with minimal complications for intrarenal stones in many studies.[3&4] Retrograde renal surgery seems to have comparable efficacy to SWL. [5-8] RIRS, preferred for renal calculi resolution smaller than 20 mm now is also applied for stone more than 20 mm size by an experienced surgeon. Depending on operator skills, stones up to 3 cm can be treated by RIRS.[9-12] Use flexible URS in cases where percutaneous nephrolithotomy or SWL are not an option (even for stones > 2 cm) .[13]

To evaluate the stone-free rate (SFR) and complications, various scoring systems have been established to enable better predication of PNL.[14] But relatively short period popularization renders only few criteria for preoperative assessment of SFR after RIRS as a first-line treatment for renal stones based on guidelines of the EAU. Resorlu et al proposed the Resorlu-Unsal stone score (RUSS) to effectively estimate the SFR, and Jung et al reported the modified Seoul National University Renal Stone Complexity score (S-ReSC) to predict the SFR after RIRS based on the affected site without stone size and numbers.[15&16] But neither of these scoring systems can predict the outcomes of the

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procedure simply, specifically and universally.[17] This study aimed to analyse the validity of R.I.R.S. innovative scoring system with regard to its capacity to estimate the stone-free rate (SFR) and complications after retrograde intrarenal surgery using R.I.R.S

Material And Methods:

This retrospective study was conducted in 50 patients of age group 18-65 years undergoing retrograde intrarenal surgery in a tertiary institute hospital from February 2022 to June 2023 after getting ethical clearance from the institutional ethical committee [EC No. EC/NIMS/2929/2022]. We reviewed the medical records of all our patients included in the study to know the pre-operative investigations, intra-operative findings and post-operative complications and follow up data. Inclusion criteria includes all patients attending Urology out patient department with symptoms of renal colic & on evaluation diagnosed to have renal stones & undergoing retrograde intrarenal surgery. Exclusion criteria were age below 18 years, pregnant women, patients with urosepsis, pelviureteric mass and multi-stage procedure. All patients presenting with symptoms suggestive of renal stones were evaluated by clinical examination and later investigated with X-ray Kidney Ureter Bladder (KUB) and ultrasound KUB. If diagnosed to have renal stones and requiring surgical intervention were further evaluated by CT KUB (plain). R.I.R.S. scoring was assessed based on CT KUB.

Regarding RIRS scoring, computed tomography urography (CTU), was used to obtain all components of the R.I.R.S. scoring system to enable a confidently reproducible prediction of the stone characteristics.[18] The table 1 demonstrates the R.I.R.S. scoring system including four different parameters: renal stone density, inferior pole stones, stone burden, and renal infundibular length (RIL)

Table I : Summary of RIRS scoring system

RIRS Score	1	2	3
Renal stone density (HU)	≤1000	>1000	
Inferior pole stone	Non inferior	Inferior with RIPA > 30^0	Inferior with RIPA≤30^0
Renal Infundibular length (RIL)(mm)	≤25mm	>25mm	
Stone burden (mm)	≤10	>10 and ≤20	>20

R.I.R.S. scoring system ranges from a minimum of 4 to a maximum of 10 points. A score of 4 points indicates the simplest calculus, while as score of 10 indicates the most complex situation. The higher the score, the more complicated the stone and more the risk of intraoperative and postoperative complications.

Postoperatively at the end of month 1 (POM1) X ray kidney-ureter-bladder (KUB) film were required to estimate surgical outcomes. Additionally, postoperative NCCT KUB was likely to be required if the preoperative Non contrast computed tomography (NCCT) KUB film showed radiolucent stones. A stone-free (SF) status was regarded as no detectable stone on KUB, and fragments of less than 2 mm on NCCT KUB were also considered negligible stones. Patients those in exclusion criteria were not taken into research study. Pre operative work for all patients done and posted for the procedure provided urine culture of the patients was negative.

Preoperative single-dose antibiotic prophylaxis was used for all patients. All patients underwent ureteral access sheath to equally facilitate stone extraction and reduce the intrarenal pressure.[19] A flexible ureteroscope (Olympus) was then advanced through the Ureteral access sheath (UAS). The stones were fragmented by holmium: YAG laser lithotripsy. If the operation time exceeded 90 min, the procedure was stopped to minimize morbidities. Postoperative double-J stent catheterization was performed and removed at approximately POM1. All procedures were performed under general anesthesia in the lithotomy position by single experienced urologist.

Data Analysis:

The data was be analysed using SPSS software version 27.0. Continuous variables were analyzed using Student's t or Mann-Whitney U tests and expressed as the mean ± SD or median (Q3-Q1; interquartile range). categorical data were analyzed by chi-square test and represented by n (%). The multivariate logistic regression models were used to assess the significance of SF status and each score component. The area under the receiver operating characteristic (AUROC) curve was used to evaluate the predictive ability of the R.I.R.S. scoring system. $p < 0.05$ was considered statistical significant.

Results

The mean Age (Years) in my study was 41.72 ± 14.05. 60% of the participants were male gender and 40% of the participants were female gender. Table II

Table II: Distribution of participants based on AGE / GENDER

Age	Number (Percent)
18-30 Years	16 (32.0%)
31-40 Years	5 (10.0%)
41-50 Years	14 (28.0%)
51-60 Years	11 (22.0%)
61-70 Years	3 (6.0%)
71-80 Years	1 (2.0%)
Gender	
Male	30 (60.0%)
Female	20 (40.0%)

90% of the participants had single number of stones.10% of the participants had two number of stones. In our study 100% of the participants had pre-operative Double J stent (DJS), sterile urine culture and sensitivity and post-operative DJS placement. The mean hospital stay (days) was 3.33±0.76 in SF group and 5.00±0.82 in non SF one . There were 13 (26%) patients who presented with inferior pole stones, and 4 cases were defined as narrow RIPA (≤30°) among those patients. The mean renal stone density was 1004.48 ± 301.65 HU in SF group and 1334.25 ± 187.72 HU in non SF group. 58% of the participants had RIL (mm): ≤ 25 mm and 42% of the participants had RIL (mm): > 25 mm. The mean renal stone burden was 13.16 ± 3.55 (mm) in SF group and 23.25 ± 3.30 (mm) in non SF group. In our study 38% of the participants had mild RIRS score (score 4-5). 60% of the participants had moderate RIRS score (score 6-8). 2% of the participants had severe RIRS score (score 9-10). Table III

Table III : Distribution of the Participants in terms of 'RIRS Score'

RIRS score	Frequency	Percentage	95% CI
Mild (score 4 - 5)	19	38.0%	25.0% - 52.8%
Moderate (score 6 - 8)	30	60.0%	45.2% - 73.3%
Severe (score 9 - 10)	1	2.0%	0.1% - 12.0%

46 out of 50 (92%) of the participants had stone free (SF) status and 4 (8%) of the participants had residual stone fragments. 22% of the participants had complications out of which 18% had complication of fever and 4% had complication of urosepsis. Table IV

Table IV: Showing association between Stone Free status and parameters

Parameters	Stone free		P value
	Yes (46)	No (4)	
Stone Location			1.000
None inferior	34 (73.9%)	3 (75.0%)	
ınferior, RIPA <30	4(8.70%)	o (0.0%)	
ınferior, RIPA >30	8(17.4%)	1 (25.0%)	
Stone Burden (mm)	13.16±3.55	23.25±3.30	0.001
Stone Density (HU"	1004.48±301.65	1334.25± 187,72	0.0281
RIL (mm)	23.24±4.71	26.25± 2.22	o. 196
R.I.R. S score	5.96± 1.15	8.00± 0.82	0.005
Preoperative DJS (Yes)	46(100.0%)	4(100.0%)	1.000
Urine culture and sensitivity (NBG)	46(100.0%)	4(100.0%)	1.000
Post-Operative DJS (Yes)	46(/00.%)	4 (100.0%)	1.000
Hospital Stay (Days)	3.33±0.76	5.00±0.82	<0.001
Complications			<0.001
None	39 (84.8%)	o (0.0%)	
Fever	5(10,9%)	4 (100.0%)	
urosepsis	2 (4.3%)	0(0.0%)	

The area under the ROC curve (AUROC) for stone burden (mm) and stone density (HU) predicting SF status was 0.989 (p = 0.001) and 0.837 (p = 0.028) respectively and it was 0.698

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(p = 0.19) for RIL (mm) which was not statistically significant. There was no significant difference in terms of distribution of SF status ($\chi 2 = 0.467$, p = 1.000 with respect to stone location.The area under the ROC curve (AUROC) for RIRS Score predicting stone free status was 0.921(p = 0.005) as shown in Fig 1, thus demonstrating excellent diagnostic performance. At a cutoff of R.I.R.S Score ≤7, it predicts SF status with a sensitivity of 91%, and a specificity of 75%. The area under the ROC curves (AUROC) for stone burden (mm) and stone density (HU), RIL (mm) predicting complications was 0.752 (p = 0.011) ,0.791 (p = 0.004) and 0.656(p = 0.118) respectively. Stone location had no significant difference between the various groups in terms of distribution of complications ($\chi 2 = 5.758$, p = 0.359). The area under the ROC curve (AUROC) for R.I.R.S. Score predicting complications was 0.8 (p = 0.002), thus demonstrating good diagnostic performance. It was statistically significant at a cutoff of R.I.R.S. Score ≥6, it predicts complications with a sensitivity of 100%, and a specificity of 49%.

Discussion

Since the invention of the flexible ureteroscope in the 1970s, advancements in endourological treatments of stones have become increasingly promising. Retrograde intrarenal surgery is less invasive than Percutaneous nephrolithotomy (PCNL) and has a lower incidence of complications. The best treatment should balance the benefits, potential complications, and total costs.[20] Accurate preoperative evaluation and preoperative planning of patient information are crucial. Many scoring systems have been established to estimate the SFR (stone free rate) after the procedure,[21] but none of these systems have been effectively and conveniently embraced in clinical practice.

Resorlu et al. first reported a scoring system called RUSS to preoperatively classify the probability of stone free status.[22] RUSS four-point scoring system might not prognosticate the SFR effectively and comprehensively when considering a complicated scenario in clinical practice.[23] Subsequently Jung et al. established a modified S-ReSC score, which is based on stone sites without stone burden and number. Ito et al. recently performed a nomogram for the SFR after RIRS, but one of the limitations of their study was in the high point range (0–25), which might be time-consuming for physicians.[21]

In this study, we aimed to assess and validate R.I.R.S. scoring system for predicting SFR following retrograde intrarenal surgery. It can favourably predict the outcomes of surgery, especially the SFR (stone free rate) of nephrolithiasis, which could facilitate not only clinical decision making but also patient counselling. In our study we assessed relation of each variable of R.I.R.S. scoring system with respect to stone free status and complications after retrograde intrarenal surgery.

As per Wang et al and Xiao et al studies, the presence of lower pole calculi and narrow RIPA (Renal infundibulopelvic angle) to be independent predictive factors of SF status after retrograde intrarenal surgery. In our study the stone location and stone free status has association but not statistically significant probably because of less number of participants with lower pole stones. RIPA <30° was an independent factor for the probability of stone clearance in the multivariate analysis. Renal infundibulo pelvic angle is of utmost importance because it may prevent the scope to reach the stone and forcing the scope into a steep angle may damage the scope flexible mechanism and the collecting system itself while trying to reach the stone.

In our study the mean renal stone density and stone burden were higher in non SF group compared to SF group which was comparable with other studies**.** Thus renal calculus density and stone burden are independent preoperative predictor of outcomes which enabled us to consult with patients, choose the suitable indications and avoid morbidities. RIL is longer in the residual stone group compared with the SF group which is similar to other studies but this finding is not significant in our study probably because of lesser sample size. As per certain studies renal infundibular length and width measurements are not precise in a noncontrast CT in an empty collecting system. Moreover, dilation of the collecting system with saline during flexible ureteroscopy probably changes the measurements of the length and width of the infundibulum thus affecting the outcome of procedure. Greater RIL had negative influence on stone free status in retrograde intrarenal surgery.

In our study out of 50 participants, 4 participants have residual fragments by POM1(postoperative one month). 3 out of 4 participants with residual stone fragments became spontaneous stone free by 3 months post procedure. 1 out of 4 participants with residual stone fragments needed redo procedure.

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The area under the ROC curve (AUROC) for R.I.R.S. Score predicting stone free status was 0.921 in our study, 0.904 in Xiao et al study, 0.737 in Wang et al study. It was found to be strongly prognostic of the final stone free status in POM1 (postoperative one month), which is better than any other variable alone.

As per the study risk of complications will be higher in patients with higher R.I.R.S. score and non-stone free group. R.I.R.S. scoring system, stone burden, stone density are statistically significant in assessing complications after RIRS. Stone location and RIL were not statistically significant in our study probably due to lesser sample size. The higher the score, the more complicated the stone and the higher will be the complications after surgery.[24&25]

R.I.R.S. scoring system and RIPA, lower pole stones, RIL, kidney stone density, and stone burden are considered as independent factors affecting the success of RIRS. In our study R.I.R.S. scoring system, stone burden, stone density are statistically significant in assessing SF status after RIRS. The higher the score, the more complicated the stone and the lower the rate of stone clearance after surgery.

R.I.R.S. scoring system is easy to repeat because the CTU can evaluate all parameters. It is an independent predictor of postoperative stone-free status. It provides high prediction accuracy (AUC = 0.921) in our study. It seems to be a reliable preoperative tool for estimating the probability of SF status after RIRS. By quantitatively estimating the complexity of stones doctors can inform patients of the probability of successful treatment and complications.

The primary limitation of our study is smaller sample size conducted in a single institute. Other limitations include the retrospective design and our exclusion criteria of musculoskeletal and renal malformations. These cases were excluded since they were low incidence and do not reflect the typical experience, but affect the outcomes. In addition, since not all patients underwent NCCT for follow-up, the evaluation between preoperative and postoperative imaging may involve a certain degree of bias. To reduce the patients radiation and economic burden, we generally use KUB to evaluate the patients SF status, and if there is suspected stone, further CT examinations are performed. This will lead to a certain error in the stone-free rate and lead to a certain degree of bias in the research results.

Conclusion

R.I.R.S. scoring system can be used to preoperatively assess treatment success by assessing stone free rate and complications after intrarenal surgery. The higher the R.I.R.S. score, the more complicated the stone and lower the rate of stone clearance and the higher will be the complications after retrograde intrarenal surgery. It seems to be a reliable preoperative tool for estimating the probability of stone-free status and complications after RIRS. By quantitatively estimating the complexity of stones surgeons can inform patients of the probability of successful treatment and complications.

References

1. Sorokin I, Mamoulakis C, Miyazawa K, et al: Epidemiology of stone disease across the world,World J Urol.2017; 35(9):1301-1320, https://doi.org/10.1007/s00345-017-2008-6

2.Turk C, Petrik A, Sarica K, Seitz C, Skolarikos A, Straub M, Knoll T, Guidelines EAU. On interventional treatment for Urolithiasis. Eur Urol. 2016;69(3):475-82. https://doi.org/10.1016/j.eururo.2015.07.041.

3.Hyams ES, Monga M, Pearle MS, Antonelli JA, Semins MJ, Assimos DG, Lingeman JE, Pais VM, Preminger GM, Lipkin ME, et al. A prospective, multi institutional study of flexible Ureteroscopy for proximal ureteral stones smaller than 2 cm. J Urol. 2015;193(1):165-9. https://doi.org/10.1016/j.juro.2014.07.002.

4.Skolarikos A, Gross AJ, Krebs A, Unal D, Bercowsky E, Eltahawy E, Somani B, de la Rosette J. Outcomes of flexible Ureterorenoscopy for solitary renal stones in the CROES URS global study. J Urol. 2015;194(1):137-43. https://doi.org/10.1016/j.juro.2015.01.112.

5.. Pearle, M.S., et al. Prospective, randomized trial comparing shock wave lithotripsy and ureteroscopy for lower pole caliceal calculi 1 cm or less. J Urol, 2005. 173: 2005. https://doi.org/10.1097/01.ju.0000158458.51706.56.

6. Srisubat, A., et al. Extracorporeal shock wave lithotripsy (ESWL) versus percutaneous nephrolithotomy (PCNL) or retrograde intrarenal surgery (RIRS) for kidney stones. Cochrane Database Syst Rev, 2014. 11: CD007044. https://doi.org/10.1002/14651858.CD007044.pub3.

7. Preminger, G.M. Management of lower pole renal calculi: shock wave lithotripsy versus percutaneous nephrolithotomy versus flexible ureteroscopy. Urol Res, 2006. 34: 108. https://doi.org/10.1007/s00240-005-0020-6.

8. Chan, L.H., et al. Primary SWL Is an Efficient and Cost-Effective Treatment for Lower Pole Renal Stones Between 10 and 20 mm in Size: A Large Single Center Study. J Endourol, 2017. 31: 510. https://doi.org/10.1089/end.2016.0825.

9. Geraghty, R., et al. Evidence for Ureterorenoscopy and Laser Fragmentation (URSL) for Large Renal Stones in the Modern Era. Curr Urol Rep, 2015. 16: 54. https://doi.org/10.1007/s11934-015-0529-3.

Document Type : Original Article Doi: https://doi.org/10.33762/bsurg.2023.143465.1058

10. Hyams, E.S., et al. Flexible ureterorenoscopy and holmium laser lithotripsy for the management of renal stone burdens that measure 2 to 3 cm: a multi-institutional experience. J Endourol, 2010. 24: 1583. https://doi.org/10.1089/end.2009.0629.

11. Riley, J.M., et al. Retrograde ureteroscopy for renal stones larger than 2.5 cm. J Endourol, 2009. 23: 1395.
https://doi.org/10.1089/end.2009.0391.

12. Akman, T., et al. Comparison of percutaneous nephrolithotomy and retrograde flexible nephrolithotripsy for the management of 2-4 cm stones: a matched-pair analysis. BJU Int, 2012. 109: 1384. https://doi.org/10.1111/j.1464-410X.2011.10691.x.

13 . EAU guidelines 2023.uroweb.org guidelines..

14.WJ W, Okeke Z. Current clinical scoring systems of percutaneous nephrolithotomy outcomes. Nat Rev Urol. 2017;14(8):459-469. https://doi.org/10.1038/nrurol.2017.71.

15.Resorlu B, Unsal A, Gulec H, Oztuna D. A new scoring system for predicting stone-free rate after retrograde intrarenal surgery: the "resorlu-unsal stone score". Urology. 2012;80(3):512 https://doi.org/10.1016/j.urology.2012.02.072.

16.Jung JW, Lee BK, Park YH, Lee S, Jeong SJ, Lee SE, Jeong CW. Modified Seoul National University renal stone complexity score for retrograde intrarenal surgery. Urolithiasis. 2014;42(4):335-40.
https://doi.org/10.1007/s00240-014-0650-7.

17.Erbin A, Tepeler A, Buldu I, Ozdemir H, Tosun M, Binbay M. External comparison of recent predictive Nomograms for stone-free rate using retrograde flexible Ureteroscopy with laser lithotripsy. J Endourol. 2016; 30(11):1180-4.
https://doi.org/10.1089/end.2016.0473.

18. Thiruchelvam N, Mostafid H, Ubhayakar G. Planning percutaneous nephrolithotomy using multidetector computed tomography urography, multiplanar reconstruction and three-dimensional reformatting. BJU Int. 2005;95(9):1280-4.
https://doi.org/10.1111/j.1464-410X.2005.05519.x.

19.Traxer O, Thomas A. Prospective evaluation and classification of ureteral wall injuries resulting from insertion of a ureteral access sheath during retrograde intrarenal surgery. J Urol.. 2013;189(2):580-4..

20.Sfoungaristos S, Gofrit ON, Mykoniatis I, Landau EH, Katafgiotis I, Pode D, Constantinides CA, Duvdevani M. External validation of Resorlu-Unsal stone score as predictor of outcomes after retrograde intrarenal surgery. Int Urol Nephrol. 2016;48(8):1247-52.
https://doi.org/10.1007/s11255-016-1311-2.

21.Ito H, Sakamaki K, Kawahara T, Terao H, Yasuda K, Kuroda S, Yao M, Kubota Y, Matsuzaki J. Development and internal validation of a nomogram for predicting stone-free status after flexible ureteroscopy for renal stones. BJU Int 2015;115(3):446-51.
https://doi.org/10.1111/bju.12775.

22. Resorlu B, Unsal A, Gulec H, Oztuna D. A new scoring system for predicting stone-free rate after retrograde intrarenal surgery: the "resorlu-unsal stone score."'Urology. 2012;80(3):512-8.
https://doi.org/10.1016/j.urology.2012.02.072.

23. Erbin A, Tepeler A, Buldu I, Ozdemir H, Tosun M, Binbay M. External comparison of recent predictive Nomograms for stone-free rate using retrograde flexible Ureteroscopy with laser

lithotripsy. J Endourol. 2016; 30(11):1180-4.
https://doi.org/10.1089/end.2016.0473.

24. Xiao Y, Li D, Chen L, et al. The R.I.R.S. scoring system: An innovative scoring system for predicting stone-free rate following retrograde intrarenal surgery. BMC Urol. 2017; 17: 105.
https://doi.org/10.1186/s12894-017-0297-0.

25. Wang C, Wang ST, Wang X, Lu J. External validation of the R.I.R.S. scoring system to predict stone-free rate after retrograde intrarenal surgery. BMC Urol. 2021; 21: 33.
https://doi.org/10.1186/s12894-021-00801-y.

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Data collection and analysis: 1
Responsibility for statistical analysis: 1,2
Writing the article:1,2 3,
Critical review: 4,5
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Each author believes that the manuscript represents honest work and certifies that the article is original, is not under consideration by any other journal, and has not been previously published.

Availability of Data and Material:
The corresponding author is prompt to supply datasets generated during and/or analyzed during the current study on wise request.

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