

# Obstructive Uropathy Treatment Complication Rate After Percutaneous Nephrostomy Versus Double J Catheter Insertion

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## ABSTRACT

**Objectives:** To compare between the retrograde double j catheterization and the percutaneous nephrostomy tube insertion as an acute management of obstructive uropathy and to demonstrate which procedure carries the least complications.

**Methods:** This retrospective study was conducted in Prince Hussein Urology Institute. (270) patients who underwent these procedures between (May-2016 and September-2017) were included, with the exclusion of severe coagulopathy, post dialysis, distal outflow obstructive uropathy patients, pediatric age groups and pregnant ladies. According to the type of the procedure, the patients, medical records were divided into two groups: group 1 (150) patients with a retrograde double j catheter insertion, group 2 (120) patients post percutaneous nephrostomy tube insertion, the follow up period was from (postoperative day 1 till definitive management), the age group range, mean age and SD were (between 22 and 64 years), (45.35), (11.03), respectively.

**Results:** Post double j catheterization, the complications were: urgency and frequency 42% (63 patients), urine leakage 9% (14 patients), dislocation 3% (5 patients), haematuria 37% (56 patients), urosepsis 20% (30 patients), catheter calcification 16% (24) and failure to insert 14% (21 patients). Whereas, post nephrostomy complications were: septicemia 5% (6 patients), bleeding 11% (13 patients), kinked tube 2% (3 patients), incorrect position 4% (5 patients) and failure of insertion 5% (6 patients).

**Conclusion:** Percutaneous nephrostomy as an initial draining procedure in acute management of upper urinary tract obstruction is superior to double j catheterization before definitive surgery.

**Keywords:** Double j catheter insertion, percutaneous nephrostomy tube insertion, The complication rate, Obstructive uropathy.

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## Introduction

Obstruction of urine flow could increase the pressure within the collecting system, which leads to kidney injury; this case is defined as obstructive uropathy. <sup>(1)</sup> This structural impedance of urine flow can occur at any level of the urinary tract from the renal calyceal system to the external meatus of the urethra. <sup>(2)</sup> Ureteric obstruction that causes upper urinary tract obstruction is divided into three categories: intraluminal, intramural and extra luminal. Ureteric stones which are the

most common cause of obstructive uropathy in the early and middle aged patients are an example for intraluminal causes. Other causes (intramural, extraluminal) are the obstetrical injury in females, malignancies such as (prostate, urinary bladder, ureteric, colon, cervical) cancer in elderly patients. <sup>(3)</sup> Since obstructive uropathy is a serious condition that can bring patients to the emergency department with an acute renal colic and sometimes may potentially led to a lethal situation in a case of infection that leads to

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urosepsis and subsequently septic shock with multi-organ failure, electrolyte disturbances, renal dysfunction with uremia and finally death; <sup>(4)</sup> Drainage procedures of the upper urinary tract like nephrostomy, double j catheter insertion and even open drainage of the kidney were offered as they are widely used as an option of management until the definitive surgery like ureteroscopy, percutaneous nephrolithotomy and extracorporeal shock wave lithotripsy as a management of the different levels of ureteric stones, or after definitive management of genitourinary malignancies and adjacent organ malignancies. <sup>(5, 6)</sup> The most widely used methods to drain the proximal urinary tract obstruction are the double j catheter insertion and percutaneous nephrostomy tube insertion. <sup>(7, 8)</sup> The choice of drainage procedure for which method to be used depend on an individualized consideration and according to the patient clinical situation because of lack clear guidelines about this issue. <sup>(8)</sup> There are many differences between these techniques depending on the following factors: 1) quality of life (which procedure is more affecting this factor), 2) success rate and 3) complication rate, which was varied between both of them according to the nature of the risk, the frequency, the intensity and the severity of each complication was noted post each procedure. The most common complications were noted post these procedures as mentioned in literature were: urinary urgency, frequency and leakage, infection or urosepsis, haematuria, dislocation and catheter encrustation, <sup>(9, 10)</sup> bleeding required transfusion or embolization, cardiac arrest, hydrothorax or pneumothorax, blockage of the PCN tube due to kinking, and inappropriate positioning of the tube. <sup>(11)</sup> In our study a comparison between these two methods after the treatment of the obstructive uropathy will be relied on to clarify which procedure has the highest success rate and which has the less complication rate.

**Methods:** This retrospective study was completed in the Royal Medical Services at Prince Hussein urology institute and included (270) patients who underwent these two procedures (retrograde double-j-catheter insertion, percutaneous nephrostomy tube insertion) between (May-2016 and

September-2017) as an emergency management for relieving obstruction in a condition where definitive treatment was not the case. In our unit skills and facilities for PCN and JJ stent insertion are equally available. The choice between them was, therefore, dependent on the clinician, inclusion criteria and patient choice. The inclusion criteria were age above pediatric age (14 years), obstructed kidney associated with infection, obstructed both kidneys, obstruction affecting renal function, obstruction in a single kidney status and all were candidates for either procedure. The exclusion criteria were pregnant ladies, severe coagulopathy, history of recent dialysis, urinary bladder tumors and patients that experienced bilateral hydronephrosis due to benign distal outflow obstruction (like benign prostatic hyperplasia and atonic bladder). It is noteworthy that retrograde DJC insertion was adopted for patients who were fit for general anesthesia, not suffering from septicemia ( $T < 38.5$ ), on anticoagulant treatment with mild to moderate impairment of coagulopathy profile, bilateral or unilateral obstructive uropathy due to external compression by a malignant process or with severe renal impairment, patients who were liable for PCN and antegrade JJ catheter insertion, but cannot tolerate a prone position due to respiratory distress or morbidly obese or patients preference. While PCN or antegrade JJ stenting criteria were: patients who had any one of the risk factors which were mentioned before for retrograde technique beside the patients who were fit for general anesthesia, but they preferred antegrade manner and avoiding the risks of G. A, when PCN was already in place it is better to insert JJ stent in an antegrade mode and lastly the patients who get a retrograde JJ failure of insertion. After obtaining the medical records of these patients, a revision of these files was formed depending on the history of the past medical illnesses, chief complaints, history of the presenting illnesses, physical examinations and all investigations were done for these patients like (complete blood count, kidney function test, electrolytes, urine analysis and cultures, radiology imaging diagnostic modalities used for these patients before the intended procedures including (plain abdomen x-rays,

renal ultrasonography and renal computed tomography). Then our research assistant divided the patients in relation to the type of the procedure into two groups as follows: group 1 which included (150) patients who underwent double j catheter insertion, group 2 included (120) patients who underwent percutaneous nephrostomy tube insertion. The groups matched well for the age (between 22 and 64 years), with a mean value of (45.35, SD= 11.03years), see Table (I) below. All patients were given second or third generation cephalosporin before and after any intervention till the finishing of a full course for each antibiotic. According to the patient clinical situation, the adjustment of every antibiotic dosage was done if there was a rising in the kidney function tests. Concerning the double-j-catheter insertion, the procedures were done in a lithotomy position either under a G. A or local anesthesia with sedation, using a 21F rigid cystoscope with working channels. Angiographic catheter was inserted through the targeted ureteric orifices; therefore a retrograde pyelogram was done by meticulous injection of the contrast media to delineate the anatomy of the upper urinary tract. And over a hydrophilic floppy tip guidewire, the double-j-catheter size (5, 6, or 7 Fr) was inserted. In the patients who underwent percutaneous nephrostomy, a complete sterilization and draping of the lumbar area with the patient in the prone position was done. Then a local anesthesia was injected in the expected punctured area by using either Xylocaine 2% (10-20 ml) or

lignocaine 1% (5-10 ml), so after the correct site of the puncture was chosen along the posterior axillary line or the renal angle with the assistance of the ultrasonography, the chiba 18-gauge needle was inserted over an incised wound in this site towards dilated pelvicalyceal system, samples were sent for culture and cytology, antegrade pyelogram was performed and the contrast was injected to outline the pelvicalyceal system, a lower pole calyx can be chosen for punctured by a 22-gauge needle under fluoroscopy guidance, then over a hydrophilic guidewire and after dilating the nephrostomy tract with the dilators, a pig tail nephrostomy tube sized from (6 to 8Fr) was put in this tract and fixed by a silk suture no.1. The complications of these two procedures were recorded in the results below according to the modified clavien grading system to report the surgical outcome of each technique,<sup>(12)</sup> taking in consideration that the follow up period of these complications was ranging from the first day post each procedure till a definitive treatment. Most of the data were presented in the form of a tabulated comparative statistics, the numbers and the percentages were generated from the categorical data by using SPSS software version 24 and the Comparison between these categorical data (N (%)) was done by chi-square test. P-value < 0.05 was considered statistically significant. Ethical committee approval was gained from our royal medical services institution for the publication of this study.

**Table I:** Age groups.

	<b>Group 1</b>	<b>Group 2</b>
<b>Age</b>	(22-61) years	(28-64) years
<b>Mean value</b>	(43.95) years	(46.66) years
<b>Standard deviation (SD)</b>	(11.90) years	(10.55) years

## Results:

In this study, we noted there were multiple causes of the obstructive uropathy that varied from the intraluminal pathology like uretric stones which were the commonest cause of the obstruction among other diseases, whether intraluminal, intramural or extra luminal like the obstetrical injury or malignancies. These illnesses were arranged in the Table (II) below according to the commonest pathology

that causes the urinary tract obstruction until the last one. Despite the proper antibiotics that were given to all patients, and the procedures were conducted in a sterile environment with a proper technique, the complications after both procedures had been occurred due to many reasons, like the time of the patients' presentations, whether early or late, the general condition of the patients, the past medical illnesses, the patients, ages, the site of

the obstruction and the coexistence of the infection. In Table (III) below, we reported the complications (either early or late) that had been occurred post each procedure according to the modified clavien grading system with the details of the patients' numbers who were exposed to these complications. These complications were treated as was mentioned in the patients, follow up notes by several methods. Septicemia was managed with the administration of intravenous fluids, intravenous antibiotics, and antipyretics and monitoring. Bleeding was managed by observation, serial PCV test, blood transfusion if required and fortunately no patient required angio-embolization. Urgency, frequency and also urine leak were dealt with an observation and treatment of the infected cause if presented in addition to adding anticholinergics or removing of the uretral stent during the definitive treatment. Catheter calcifications were also treated with the ureteroscopic disintegration of the stones

using lithoclast or extra corporeal shock wave lithotripsy. Failure of the double j catheter insertion was lead to the PCN or antegrade double j catheter insertion, while failure of PCN or antegrade JJ stenting was dealt according to the underlying cause: uncooperative patients were underwent retrograde JJ insertion under local anesthesia with sedation, patients in septic shock were put on a good intravenous antibiotics and close monitoring till they can do either procedure (retrograde or antegrade) and the patients who failed PCN tract, kinked nephrostomy tube or incorrectly positioned, the solution was retrograde JJ insertion method or another trial of reinsertion of nephrostomy tube. So as a result, the complication rate post the double j catheter insertion was more than that was seen post the percutaneous nephrostomy tube insertion, with the estimated P-values of these complications regarding the comparison between the two procedures were shown in Table II. (Significant P-value was < 0.05).

**Table II:** Causes of obstructive uropathy.

Causes\ Groups	Group 1 (N*=150) (%)	Group 2 (N=120) (%)
Uretric stones	(N=63) (42%)	(N=48) (40%)
Renal stones	(N=41) (27.33%)	(N=43) (35.8%)
PUJ® obstruction	(N=17) (11.33%)	(N=9) (7.5%)
Cervix carcinoma	(N=9) (6%)	(N=7) (5.83%)
Retroperitoneal fibrosis	(N=7) (4.67%)	(N=5) (4.2%)
Prostate carcinoma	(N=6) (4%)	(N=4) (3.33%)
Pyonephrosis	(N=4) (2.67%)	(N=3) (2.5%)
Emphysematous pyelonephritis	(N=3) (2%)	(N=1) (0.83%)

\*n: number of the patients. ®PUJ: pelviuretric junction.

**Table III:** Complications after each Procedure according to the modified clavien system.

Complications(grades) procedures	Double j catheter insertion	Percutaneous nephrostomy	P-Value©
Urgency and frequency (grade 1)	63 (42%)	0 (0%)	0.001
Incontinence (grade 1)	14 (9%)	0 (0%)	0.004
Haematuria vs. bleeding (grade 1\ grade 2)	56 (37%)	13 (11%)	0.049
Kinked tube (grade 3a)	0 (0%)	3 (2%)	0.018
Incorrect position (grade 3a)	0 (0%)	5 (4%)	0.012
Failure of insertion (grade 3a+3b)	21 (14%)	6 (5%)	0.027
Dislocation (Grade 3b)	5 (3%)	0 (0%)	0.007
Catheter incrustation or calcification (grade 3b)	24 (16%)	0 (0%)	0.015
Urosepsis or septicemia (grade 2\ grade 4b)	30 (20%)	6 (5%)	0.029

©: P-value was estimated in comparison between of both groups. (significant P-value <0.05 was considered).

## Discussion:

In this study, the double j catheterization was done either under a general or local anesthesia with sedation. The complications post this procedure were Urgency and frequency,

Incontinence, hematuria and urosepsis or septicemia v bm. (due to the urinary tract instrumentation by Cystoscopy and the resultant injury of the urinary tract components or secondary to the placement of

the JJ stent in the setting of an emergency intervention). The other complications were: failure of catheter insertion (secondary to the complete obstruction of the ureter by the causative stone or by the external compression due to a malignant process), dislocation and encrustation. On the other hand, only the local anesthesia was required for the percutaneous nephrostomy (PCN) tube insertion, therefore, the general anesthesia or sedation was avoided. Also, complications post this technique were: hematuria (secondary to the entrance of the collecting system or the existence of a foreign body like the nephrostomy tube or DJC), bleeding (due the risk of vascular injury during the intervention itself), failure of insertion to the upper urinary tract and urosepsis or septicemia (which may be fatal) as a result of the rapid decompression of a closed infected system. In brief, these complications were noticed less frequently than those with post DJC insertions. There were other two complications post PCN (kinked tube and incorrect position), which were not seen post DJC insertion because they were related to the nephrostomy tube itself. So, the complication rate after PCN was lower than that after JJ stent insertion. This was especially so for the life-threatening complication of septicemia (5% vs. 20%). Whereas that, frequency and dysuria were unpleasant for the patient with DJC but are much less serious than septicemia. In our hands, PCN was a technically easier procedure with less frequent failure of insertion (5% vs. 14%). Although not specifically measured in this study, PCN appeared to cause more discomfort in regards to the free mobility of the ambulatory patients. It is noteworthy that the authors of this study are fortunate in having free access to both procedures; some other units lack facilities for PCN 24 hours a day availability. In the urology practice for many years, using of the ureteric stents has been adopted to the relief of the ureteral obstruction, but many complications were encountered during its use. The most common complications were noticed in literature: irritative voiding symptoms, incontinence, hematuria, bleeding requiring blood transfusion, urosepsis or septicemia and catheter encrustation).<sup>(13, 14)</sup> Due to the high risk and morbidity of the

encrustation of double j catheter with the other associated urinary symptoms, the treating urologist should discuss clearly to the patient the temporary intent of the internal stents.<sup>(15)</sup> There are several factors that play a role in increasing the complication rate of double j stenting like (longer stents and older patients).<sup>(16)</sup> Therefore the decision of the uretral catheterization should not be taken lightly as it is a double edged weapon (friend or enemy) due to the high complication rate.<sup>(17)</sup> Total in all, this supports our idea that the uretric stents carry a significant risk of complications that needs an accurate timing of removal and changing. Percutaneous nephrostomy tube insertion is not out of complications also. Many serious complications post PCN could occur like: Septic shock, bleeding requiring blood transfusion, vascular injury requiring embolization or nephrectomy, bowel injury and Pleural complications.<sup>(18)</sup> Displacement of PCN catheter could be a complication post PCN tube insertion also.<sup>(19)</sup> These complications were divided into early and late.<sup>(20)</sup> An unusual complication like guidewire fracture may occur.<sup>(21)</sup> Despite there are several risk factors that could be implicated in the occurrence of the complications post PCN the only proven one that influence the development of these complications is obesity.<sup>(22)</sup> So, regarding these data and our results; PCN tube insertion is a transient procedure also, because it is not free of complications, but the complication rate is less than that post double j catheterization. The Indications for percutaneous nephrostomy were: a urinary diversion, treatment of the nephrolithiasis and complex urinary tract infections, ureteral intervention, and nephroscopy and ureteroscopy.<sup>(23)</sup> Antegrade percutaneous snaring of double j catheter also a safe indication of PCN.<sup>(24)</sup> The most common extension of percutaneous nephrostomy is the placement of a ureteral stent for the treatment of the urinary obstruction or ureteral perforation, this technique is safe, effective and has a high degree of success rate.<sup>(25)</sup> So that, the training on PCN to perform the antegrade double j catheterization should be encouraged.<sup>(26)</sup> In the contrast of our study, Ljubomir Dinic and colleagues mentioned

similar incidences of the complications post both procedures, except for the pain, urinary symptoms and asymptomatic bacteriuria. <sup>(27)</sup> In some articles, the authors reported the superiority of the DJC insertion over PCN tube insertion if ESWL (Extra Corporeal Shock Wave Lithotripsy) is not available in situ for the treatment of the obstructive uropathy, <sup>(28)</sup> these findings are against our outcomes. On the other side, In the acute or chronic renal failure due to an intrinsic or an extrinsic ureteral obstruction caused mainly by malignancies like prostate, urinary bladder, and uterine, the PCN was found to be the most appropriate procedure to preserve the renal functions, <sup>(29)</sup> and the success rate of PCN was higher than that in the double j catheter insertion. <sup>(30)</sup> So, the PCN is better than the retrograde double j catheterization due to the lower risk of the complications, more safety and high success rate, and seems to be a good option for antegrade JJ stent insertion as an alternative to the retrograde approach, especially when the latter had failed or when PCN had already been placed, <sup>(31)</sup> which was going with our findings. Finally, the best treatment choice of a particular procedure was depending on the site of the obstruction, the degree of the proximal obstruction and the local expertise. <sup>(32)</sup>

#### Conclusion:

PCN is superior to the retrograde double J catheter insertion in the management of supravescical obstruction associated with infection or renal impairment. The complication rate in PCN approach is less with a higher success rate. In centers with the lack of expertise in the nephrostomy tract creation and management, the retrograde double J catheter insertion is still a safe and successful option.

#### References:

1- **Sood G., Sood A., Jindal A., Verma D.K., Dhiman D.S.** Ultrasound guided percutaneous nephrostomy for obstructive uropathy in benign and malignant diseases. *Int. braz j urol.* [Internet]. 2006 June [cited 2018 Apr 17]; 32(3): 281-286.

- 2- **Mohammed MA.** M Ibnouf et al., Comparison between Double 'J' Ureteral Stenting versus Percutaneous Nephrostomy in Obstructive Uropathy in Sudan, 2015: *SAS J. Surg.*, 2015; 1(3):80-87
- 3- **Naeem, Muhammad, Mir Alam Jan,** Anayat Ullah, Liaqat Ali, Sarhad Khan, Amin ul Haq, Sajjad Ahmad, & Atta ur Rehman. "Percutaneous Nephrostomy For The Relief Of Upper Urinary Tract Obstruction: An Experience With 200 Cases. *Jpmi* 2010 Vol.24 Nov. 02:147-152.
- 4- **Iftikhar Ahmad1, Mudassar Saeed Pansota2, Muhammad Tariq3, et al.** Comparison Between Double J (DJ) Ureteral Stenting and Percutaneous Nephrostomy (PCN) in Obstructive Uropathy: *Pak J Med Sci* 2013;29(3):725-729.'
- 5- **Yousef S.** Matani, MD, FRCS; Mohammed A. Al-Ghazo, MD, FRCS; Rami S. Al-Azab, MD; et al. Emergency versus elective ureteroscopic treatment of ureteral stones: *Can Urol Assoc J* 2013;7(7-8):e470-4.
- 6- **Wilson JR, Urwin GH, Stower MJ, et al.** The role of percutaneous nephrostomy in malignant ureteric obstruction. *Ann R CollSurg Engl.* 2005;87:21-4.
- 7- **Olivera Stojceva-Taneva, Ivo Ribar Lola, et al.** Obstructive Nephropathy as a Result of Malignant Neoplasms: A Single Centre Experience. *BANTAO Journal* 2010; 8 (2): 71-74.
- 8- **Linda Hsu, Hanhan Li, Daniel Pucheril, Moritz Hansen, et al.** Use of percutaneous nephrostomy and ureteral stenting in management of ureteral obstruction: *World J Nephrol* 2016 March 6; 5(2): 172-181.
- 9- **Mudassar Saeed Pansota, Mumtaz Rasool, Muhammad Shahzad Saleem, et al.** Indications And Complications Of Double J Ureteral Stenting: Our Experience. *Gomal J Med Sci* 2013; 11:8-12.
- 10- **Richter S, Ringel A, Shalev, Nissenkorm I, et al.** The Indwelling Ureteric Stent: a 'friendly' procedure with unfriendly high morbidity. *BJU Intl.* 2009;85(4):408-11.
- 11- **Radecka E, Magnusson A, et al.** Complications associated with percutaneous nephrostomies. A retrospective study. *Acta Radiol* 2004;45:184-188.
- 12- **Dindo D, Demartines N, Clavien PA.** Classification of surgical complications: a

new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004; 240(2):205-213.

13- **Raymond B. Dyer, Michael Y. Chen, Ronald J. Zagoria, et al.** Complications of Ureteral Stent Placement: *RadioGraphics* 2002; 22:1005–1022.

14- **K. Singh, Aditya & K. Shukla, Pushpendra & W. Khan, Sartaj & S. Rathee, Vazir & Shankar Dwivedi, Udai & Trivedi, Sameer.** (2017). Using the Modified Clavien Grading System to Classify Complications of Percutaneous Nephrolithotomy. *Current Urology*. 11. 79-84. 10.1159/000447198.

15- **Brian A. Vanderbrink, M.D., Ardeshir R. Rastinehad, D.O., Michael C. OST, M.D., et al.** Encrusted Urinary Stents: Evaluation and Endourologic Management: *Journal Of Endourology* Volume 22, Number 5, May 2008;905-912.

16- **Mohammed S. Al-Marhoon \*, Omar Shareef, Krishna P. Venkiteswaran, et al.** Complications and outcomes of JJ stenting of the ureter in urological practice: A single-centre experience I. *Arab Journal of Urology* (2012) 10, 372–377.

17- **Memon NA, Talpur AA, Memon JM.** Indications and complications of indwelling ureteral stenting at NMCH, Nawabshah. *Pak J of Surg* 2007; 23:187-91.

18- **Parvati Ramchandani, MD, John F. Cardella, MD, Clement J. Grassi, MD, et al.** Quality Improvement Guidelines for Percutaneous Nephrostomy: *J Vasc Interv Radiol* 2003; 14:S277–S281.

19- **Khalid Saeed, Farhan Qureshi, Imran Hussain, et al.** Frequency Of Complications Of Percutaneous Nephrostomy In Upper Obstructive Uropathy: *Iszmc* 2016;7(1):922-924.

20- **Dr. Sandeep Gupta, Dr. Sajad Ahmad Para, Dr. Prof. Dilipkumar Pal, et al.** Complications of Ultrasound Guided Percutaneous Nephrostomy-A Hospital, based study: *Sch. J. App. Med. Sci.*, 2017; 5(6E):2383-2387.

21- **Francesca Manassero, Simona Ortori, Cristina Gabellieri, et al.** An unusual case of intrarenal coiled and ruptured guidewire: *Archivio Italiano di Urologia e Andrologia* 2015; 87, 1.

22- **José Antonio Rodríguez-Pontones and David Bretón-Reyes.** Complications in

patients undergoing ultrasound-guided percutaneous nephrostomy and associated factors: *Gac Med Mex.* 2016;152:147-52.

23- **Raymond B. Dyer, MD • John D. Regan, MD • Peter V. Kavanagh, MD.** Percutaneous Nephrostomy with Extensions of the Technique: Step by Step. *RadioGraphics* 2002; 22:503–525.

24- **Huei-Lung Liang, Tsung-Lung Yang, Jer-Shyung Huang, et al:** *American Journal of Roentgenology* 2008 191:5, 1530-1535

25- **Stamatiou, Konstantinos & Avakian, Raffi & Papadatou, et al.** (2013). Treatment of urinoma due to ureteral perforation by percutaneous nephrostomy (PCN) and antegrade placement of ureteral stent. *Hellenic Urology*. 26. 45-47.

26- **Anthony Kodzo-Grey Venyo, Tessa Hanley, Michael Barrett, Ali Nawaz Khan.** Ante-grade ureteric stenting, retrospective experience in managing 89 patients: Indications, complications and outcome: *Journal of Biomedical Graphics and Computing*, 2014, Vol. 4, No. 3: 47-56.

27- **Ljubomir Dinić, Jablan Stanković, Milan Potić, ET AL.** Percutaneous Nephrostomy And Double Pigtail (Jj) Ureteral Stents As Temporary Methods In Solving Supravesical Obstruction Caused By STONE: *Acta medicamediana* 2015, Vol.54(3),39-44.

28- **H.B. JOSHI, O.O. OBADEYI and P.N. RAO.** A comparative analysis of nephrostomy, JJ stent and urgent in situ extracorporeal shock wave lithotripsy for obstructing ureteric stones: *BJU International* (1999), 84, 264–269.

29- **Vinamra Mittal, Manoj Biswas, Shobha LaL.** Percutaneous nephrostomy or double J stenting, which is better modality for obstructive uropathy-a descriptive study: Mittal V et al. *Int J Res Med Sci.* 2016 Aug;4(8):3486-3491.

30- **Alexandre Danilovic, Ioannis M. Antonopoulos, Jose L. Mesquita, Antonio M. Lucon.** Likelihood Of Retrograde Double-J Stenting According To Ureteral Obstructing Pathology: *Int Braz J Urol.* 2005; 31: 431-6.

31- **R. W. van der Meer, S. Weltings, A. R. van Erkel, ET AL.** Antegrade ureteral stenting as an alternative for a retrograde approach: indications, success rate and complications: *ECR2014\_C-0474:* 1-8.

32- **Rammohan T, Panduranga Rao K, Prasad D. V. S. R. K, Et Al.** A Comparative Study Of Percutaneous Nephrostomy Versus Dj Stenting In Infective Hydronephrosis In

Calculous Disease: *Journal Of Evolution Of Medical And Dental Sciences* 2015; Vol. 4, Issue 18, March 02; Page: 3143-3153.