

**Radiologic Management of Urinary Tract Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Goodwin WE, Casey WC, Woolf W. Percutaneous trocar (needle) nephrostomy in hydronephrosis. <i>J Am Med Assoc</i> 1955; 157(11):891-894.	Review/Other-Tx	16 patients	To describe indications for and the technique and results of trocar nephrostomy in selected cases of hydronephrosis.	Trocar nephrostomy may be a useful method of temporary urinary diversion. Further evaluation of technique is needed.	4
2. Dassouli B, Benlemlih A, Joual A, et al. [Percutaneous nephrostomy in emergencies. Report of 42 cases]. <i>Ann Urol (Paris)</i> 2001; 35(6):305-308.	Review/Other-Tx	42 cases	Retrospective study to demonstrate the interest and the contribution of the PCN in obstructive anuria and in pyonephrosis.	Improvement of the renal function was noted in 100% of obstructive with anuria and apyrexia in every case of pyonephrosis. No major complication arose during the realization of the nephrostomy. The long-term prognostic depends on the etiology.	4
3. Lee WJ, Mond DJ, Patel M, Pillari GP. Emergency percutaneous nephrostomy: technical success based on level of operator experience. <i>J Vasc Interv Radiol</i> 1994; 5(2):327-330.	Review/Other-Tx	160 patients; 169 emergency PCN	Prospective study to evaluate the impact of operator experience on emergency PCN. Three categories of operator experience were compared based on the number of PCN performed each year (level 1 is >20, level 2 is 10-20, or level 3 is <10).	At threshold of 10 or more procedures per year, operator experience has little impact on immediate technical success. Level of experiences does impact fluoroscopy and procedure time, minor complications, and need for repeat procedures.	4
4. Lee WJ, Patel U, Patel S, Pillari GP. Emergency percutaneous nephrostomy: results and complications. <i>J Vasc Interv Radiol</i> 1994; 5(1):135-139.	Observational-Tx	160 patients	To evaluate the effectiveness and safety of PCN in an emergency setting.	Technical success rate was 98%. Complication rate was 34% (6% major and 28% minor). Emergency PCN under fluoroscopic guidance is a simple, safe, and effective procedure and should be offered in all suitably equipped radiology departments.	3
5. Angulo JC, Gaspar MJ, Rodriguez N, Garcia-Tello A, Torres G, Nunez C. The value of C-reactive protein determination in patients with renal colic to decide urgent urinary diversion. <i>Urology</i> 2010; 76(2):301-306.	Observational-Dx	110 consecutive patients	To analyze whether C-reactive protein predicts the need for urgent urinary diversion in patients with renal colic and urolithiasis.	Mean C-reactive protein value was 47.6 mg/L (CI, 31.4-63.8), 139.6 mg/L (CI, 13-183.1) in 29 patients treated with diversion and 14.67 mg/L (CI, 6.7-22.5) in the control group (P<.001). Age, sex, rate of patients with hypertension, history of cardiovascular disease, leukocyte total count, and serum creatinine differed between groups (P<.05). Regression analysis revealed C-reactive protein (P<.0001) and age (P=.0001) were predictive of urinary diversion. Receiver operating characteristic analysis revealed 68.4% area under the curve for creatinine, 68.8% for leukocytosis, and 86.8% for C-reactive protein. A cut-off point for C-reactive protein of 28 mg/L achieved optimum sensitivity (75.8%) and specificity (88.9%) for determining the decision for drainage.	3

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6. Camunez F, Echenagusia A, Prieto ML, Salom P, Herranz F, Hernandez C. Percutaneous nephrostomy in pyonephrosis. <i>Urol Radiol</i> 1989; 11(2):77-81.	Review/Other-Tx	73 patients; 76 pyonephrotic kidneys	Patients were drained by PCN tube and examined to evaluate role of PCN for pyonephrosis.	Clinical symptoms resolved 24-48 hours after drainage in 71/73 patients. After acute phase had remitted, interventional procedures were done in 39 cases (definitive therapy in 36). Elective surgery was the definitive therapy in 32 cases, including the 3 cases not resolved after interventional procedures.	4
7. Lang EK, Price ET. Redefinitions of indications for percutaneous nephrostomy. <i>Radiology</i> 1983; 147(2):419-426.	Review/Other-Tx	218 patients	To analyze patients treated by PCN and identify its indications and failures.	PCN reduced the mortality from gram-negative septicemia from 40% to 8%. PCN was the single most important treatment modality in patients with septicemia and obstructive uropathy.	4
8. Nicolescu D, Boja R, Osanu V, et al. Emergency percutaneous nephrostomy in the septic kidney. <i>Acta Urol Belg</i> 1992; 60(1):27-32.	Review/Other-Tx	64 patients	To evaluate the role of emergency PCN in patients presenting with toxico-septic shock.	Survival in 53/64 patients. There were 11 deaths. Under the protection of PCN, the stone generating obstructive uropathy was removed subsequently, after the improvement of biological constants and general state of the patient.	4
9. Ng CK, Yip SK, Sim LS, et al. Outcome of percutaneous nephrostomy for the management of pyonephrosis. <i>Asian J Surg</i> 2002; 25(3):215-219.	Review/Other-Tx	92 consecutive patients	Retrospective study to evaluate the efficacy of PCN drainage for the interim management of pyonephrosis.	30% of bladder urine cultures were positive for microorganisms; the addition of PCN cultures improved this yield to 58%. PCN cultures yield important bacteriological information. The procedure is associated with minimal morbidity, facilitates definitive treatment and provides therapeutic benefit.	4
10. Watson RA, Esposito M, Richter F, Irwin RJ, Jr., Lang EK. Percutaneous nephrostomy as adjunct management in advanced upper urinary tract infection. <i>Urology</i> 1999; 54(2):234-239.	Review/Other-Tx	315 patients	Retrospective review of PCN, performed for pyonephrosis to determine whether this intervention has major clinical advantages.	PCN is potentially lifesaving in pyonephrosis. In particular, this review focuses attention on the clinically important insight that urine cultures from PCN drainage often identify pathogens that differ from those detected in concurrent bladder cultures.	4
11. Soltes GD, Rainwater JR, Middlebrook MR, Cohen AM, Sickler GK, Sandler CM. Interventional uro radiology. <i>World J Urol</i> 1998; 16(1):52-61.	Review/Other-Tx	N/A	To review issues pertaining to percutaneous urologic interventions. Emphasis is on urologic calculi, interventional therapy for neoplasms and trauma of the urinary tract, diagnosis and treatment of renovascular hypertension, and the management of complications following renal transplantation.	Interventional uro radiologic techniques have impacted the care of the urologic patient by allowing nonoperative treatment of many disease processes.	4
12. Banner MP, Ramchandani P, Pollack HM. Interventional procedures in the upper urinary tract. <i>Cardiovasc Intervent Radiol</i> 1991; 14(5):267-284.	Review/Other-Tx	N/A	Review interventional techniques for renal disease. Authors emphasize frequently performed procedures and their preferences and perspectives on these procedures.	PCN and other percutaneous therapies are widely available and safe.	4

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13. Cochran ST, Barbaric ZL, Lee JJ, Kashfian P. Percutaneous nephrostomy tube placement: an outpatient procedure? <i>Radiology</i> 1991; 179(3):843-847.	Observational-Tx	55 patients; 56 PCN	A report on authors experience with PCN performed as an outpatient procedure.	With good vigilance for sepsis, PCN can frequently be performed as outpatient procedure.	3
14. Zagoria RJ, Dyer RB. Do's and don't's of percutaneous nephrostomy. <i>Acad Radiol</i> 1999; 6(6):370-377.	Review/Other-Tx	N/A	Report problems and issues related to nephrostomies. Summary of precautions necessary to minimize complications of nephrostomies.	PCN procedures generally are safe. Mortality rate is approximately 0.04%, and the incidence of important complications is 5% (2-4).	4
15. Bartone FF, Hurwitz RS, Rojas EL, Steinberg E, Franceschini R. The role of percutaneous nephrostomy in the management of obstructing candidiasis of the urinary tract in infants. <i>J Urol</i> 1988; 140(2):338-341.	Review/Other-Tx	5 neonates	To evaluate the role of PCN in obstructing candidacies in infants.	Technical success in 3/5 cases. PCN with antegrade amphotericin B irrigation, coupled with systemic antifungal therapy, is the mainstay of treatment.	4
16. Bell DA, Rose SC, Starr NK, Jaffe RB, Miller FJ, Jr. Percutaneous nephrostomy for nonoperative management of fungal urinary tract infections. <i>J Vasc Interv Radiol</i> 1993; 4(2):311-315.	Review/Other-Tx	7 patients (2 neonates and 5 adults)	To retrospectively review experience with PCN in the management of fungal pyonephrosis.	PCN allowed: Prompt microbiologic diagnosis of fungal infection (<i>Candida albicans</i> in 6 patients, <i>Torulopsis glabrata</i> in one); Urinary diversion with subsequent improvement in renal function, enabling systemic administration of potentially toxic antifungal drugs 5-fluorocytosine and amphotericin B (4 patients); Local irrigation with amphotericin B (4 patients); Guide-wire fragmentation of fungus balls (2 patients); and Introduction of a Simpson atherectomy device to obtain biopsy specimens from an obstructing ureteral polypoid lesion (1 patient).	4
17. Morelli G, Felipetto R, Biver P, Bottone U, Minervini R. Use of new nephrostomy catheter for treatment of renal neonatal candidiasis. <i>Eur Urol</i> 1997; 32(4):485-486.	Review/Other-Tx	3 cases	To evaluate efficacy of PCN in neonatal renal candidacies.	Funguria was successfully eradicated in all cases. Availability of a nephrostomy trocar of small dimensions leads to improved renal approach in newborns.	4
18. Farrell TA, Hicks ME. A review of radiologically guided percutaneous nephrostomies in 303 patients. <i>J Vasc Interv Radiol</i> 1997; 8(5):769-774.	Observational-Tx	303 patients; 454 consecutive PCN	Retrospective review to determine the morbidity and mortality associated with radiologically guided PCN and to identify possible contributory risk factors.	Technical success was 99%. Overall complication rate was 6.5%, including hemorrhage requiring transfusion after 13 PCNs (2.8%). A baseline platelet count of <100,000/mm ³ was a significant risk factor for hemorrhage requiring blood transfusion. The 30-day mortality rate was 3.1%; however, none of these deaths were procedure related.	3

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19. Joshi HB, Obadeyi OO, Rao PN. A comparative analysis of nephrostomy, JJ stent and urgent in situ extracorporeal shock wave lithotripsy for obstructing ureteric stones. <i>BJU Int</i> 1999; 84(3):264-269.	Observational-Tx	82 consecutive patients	Retrospective analysis to determine the optimal method of treatment for ureteric stones causing complete obstruction, treated by insertion of a JJ stent or a nephrostomy tube, followed by extracorporeal shock wave lithotripsy or by urgent in situ extracorporeal shock wave lithotripsy if readily available.	Urgent in situ extracorporeal shock wave lithotripsy (group 3) had a median (95% CI) success rate of 81% (54%-96%), compared with 70% (53%-83%) in group 2 and 54% (33%-73%) in group 1. If facilities are available, urgent in situ extracorporeal shock wave lithotripsy appears to be the choice of treatment for obstructing ureteric stones. If such facilities are not available, a JJ stent may offer better success than a PCN.	2
20. Mokhmalji H, Braun PM, Martinez Portillo FJ, Siegmund M, Alken P, Kohrman KU. Percutaneous nephrostomy versus ureteral stents for diversion of hydronephrosis caused by stones: a prospective, randomized clinical trial. <i>J Urol</i> 2001; 165(4):1088-1092.	Experimental-Tx	40 patients	Prospective, randomized clinical trial to compare PCN with ureteral stents for diversion of hydronephrosis caused by stones.	PCN was successfully completed in 100% of patients and stents were successful in 80%, with a 20% conversion to PCN. Results indicate PCN is superior to ureteral stents for diversion of hydronephrosis caused by stones, especially in patients with a high temperature, as well as in males and juveniles.	1
21. Barton DP, Morse SS, Fiorica JV, Hoffman MS, Roberts WS, Cavanagh D. Percutaneous nephrostomy and ureteral stenting in gynecologic malignancies. <i>Obstet Gynecol</i> 1992; 80(5):805-811.	Observational-Tx	40 patients	Retrospective study to identify the indications, complications, and efficacy of PCNs and ureteral stents in women with gynecologic cancer.	Renal function was abnormal in 26 patients. Abnormal renal function improved in 14/26. Median survival was 5.5 months. Techniques are safe and often improve renal function.	2
22. Dudley BS, Gershenson DM, Kavanagh JJ, Copeland LJ, Carrasco CH, Rutledge FN. Percutaneous nephrostomy catheter use in gynecologic malignancy: M.D. Anderson Hospital experience. <i>Gynecol Oncol</i> 1986; 24(3):273-278.	Review/Other-Tx	30 patients	A study on the follow-up of the clinical courses of 30 patients with 41 nephrostomy catheters.	Common complications were hemorrhage (28%), infection (70%), and blockage of catheter (65%). No deaths occurred as a result of these complications. Renal function recovered in 14/20 patients (70%) who presented with elevated creatinine values. 26/28 patients with malignant obstruction were able to receive further therapy. The only long-term survivors presented with primary advanced cervical cancer.	4
23. Culkin DJ, Wheeler JS, Jr., Marsans RE, Nam SI, Canning JR. Percutaneous nephrostomy for palliation of metastatic ureteral obstruction. <i>Urology</i> 1987; 30(3):229-231.	Review/Other-Tx	27 patients	To evaluate the role of PCN for palliative decompression in malignant ureteric obstruction.	Improved survival and less morbidity compared with historical open decompression. Patients with prostate, rectal and cervical cancers have best survival. Mean survival of all patients was 6.63 months (n=19).	4

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24. Allen DJ, Longhorn SE, Philp T, Smith RD, Choong S. Percutaneous urinary drainage and ureteric stenting in malignant disease. <i>Clin Oncol (R Coll Radiol)</i> 2010; 22(9):733-739.	Review/Other-Tx	N/A	An overview to describe the surgical principles and technical issues involved with the endoscopic and percutaneous options in malignant ureteric obstruction.	Patients with malignant ureteric obstruction often have a poor life expectancy, even if relief of urinary obstruction is achieved. Careful discussion between the patient, their family and health care professionals involved in the case must be undertaken before any intervention. The goal of treatment in the palliative setting may be to offer symptom relief, avoid complications from renal insufficiency or allow further oncological systemic therapy. The obstruction can be relieved by placement of a PCN tube, a ureteric stent or, more rarely, due to the palliative nature of the patients, a more complex open surgical procedure.	4
25. Jalbani MH, Deenari RA, Dholia KR, Oad AK, Arbani IA. Role of percutaneous nephrostomy (PCN) in malignant ureteral obstruction. <i>J Pak Med Assoc</i> 2010; 60(4):280-283.	Observational-Tx	40 patients	To assess whether PCN placement in patients having malignant ureteric obstruction can provide patient benefit or increase morbidity.	Patients having early or urogenital malignancies benefited from the PCN placement while patients with advanced malignancies and nonurogenital malignancies showed poor response. The median survival in urogenital malignancies was about 350 days (range was 150-700 days), and in nonurogenital malignancies except lymphoma it was about 25 days. (Range was 7-80 days). Loss of nephrostomy catheter was the most frequent complication observed in this series.	2
26. Lapitan MC, Buckley BS. Impact of palliative urinary diversion by percutaneous nephrostomy drainage and ureteral stenting among patients with advanced cervical cancer and obstructive uropathy: a prospective cohort. <i>J Obstet Gynaecol Res</i> 2011; 37(8):1061-1070.	Observational-Tx	198 patients	To evaluate the benefits offered by urinary diversion by comparing survival among those requiring and undergoing diversion with those requiring but not undergoing and those not requiring the procedure.	Complete data were available for 198 patients, of whom 93 underwent diversion, 56 required diversion but elected not to receive it, and 49 did not require it. Although survival at 12 months among those who underwent diversion was no greater than among those who required but elected not to receive the procedure, diversion was associated with significantly improved chance of survival in the shorter term. There was no significant difference in the QOL between the groups throughout the study.	1

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27. Plesinac-Karapandzic V, Masulovic D, Markovic B, et al. Percutaneous nephrostomy in the management of advanced and terminal-stage gynecologic malignancies: outcome and complications. <i>Eur J Gynaecol Oncol</i> 2010; 31(6):645-650.	Observational-Tx	117 patients	To evaluate the outcome and complications after PCN insertion in advanced and terminal-stage gynecological malignancies with ureteral obstruction.	The median age was 51 years (range 28-85). Bilateral nephrostomy was performed in 36.7% and unilateral in 63.3%. Renal function normalization occurred in 24.8%. 2-year OS was 16.8%. Higher OS occurred in patients without initial azotemia versus those with azotemia (26.8% vs 13.9%). Median survival time for all the patients was 7 months, 8 in primary cases versus 6 in recurrent ones, and 8 months in patients after initial therapy. Complications appeared in 53.85%. Most frequent were the loss of the nephrostomy catheter in 37.61% and urinary tract infections in 19.6%.	2
28. Aravantinos E, Anagnostou T, Karatzas AD, Papakonstantinou W, Samarinas M, Melekos MD. Percutaneous nephrostomy in patients with tumors of advanced stage: treatment dilemmas and impact on clinical course and quality of life. <i>J Endourol</i> 2007; 21(11):1297-1302.	Observational-Tx	270 patients	To evaluate the outcome, in respect to safety, survival, and QOL, after performance of PCN in patients with obstructive nephropathy caused by various types of advanced malignancy.	Although PCN has shown good safety characteristics and beneficial impact on renal function, only patients with specific cancers most likely to respond to ongoing palliative therapy or with cancers that progress slowly by nature may statistically benefit from the procedure. This questions the universal application of this procedure for all types and stages of advanced malignancy.	2
29. Harrington KJ, Pandha HS, Kelly SA, Lambert HE, Jackson JE, Waxman J. Palliation of obstructive nephropathy due to malignancy. <i>Br J Urol</i> 1995; 76(1):101-107.	Review/Other-Tx	42 patients	Prospective study of patients with malignant obstructive uropathy treated actively by PCN and JJ ureteric stents.	Median survival of all patients was 133 (range 7-712) days. 17 patients (40%) survived for >6 months and five (12%) for <1 month. Patients who had received no prior therapy and for whom further therapeutic options were available were more likely to benefit from urinary diversion.	4
30. Chan S, Robinson AC, Johnson RJ. Percutaneous nephrostomy: its value in obstructive uropathy complicating carcinoma of cervix uterus. <i>Clin Oncol (R Coll Radiol)</i> 1990; 2(3):156-158.	Review/Other-Tx	25 patients	To evaluate the role of PCN in obstructive uropathy secondary to cervical cancer.	Best results in patients with no previous cancer treatment and in patients with treatment-related complications.	4
31. Feuer GA, Fruchter R, Seruri E, Maiman M, Remy JC, Boyce JG. Selection for percutaneous nephrostomy in gynecologic cancer patients. <i>Gynecol Oncol</i> 1991; 42(1):60-63.	Observational-Tx	22 patients	To determine if evaluation prior to PCN could accurately predict patients who would benefit from intervention.	Patients without contraindications to PCN survive longer and have better QOL than terminal patients.	1

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32. Chapman ME, Reid JH. Use of percutaneous nephrostomy in malignant ureteric obstruction. <i>Br J Radiol</i> 1991; 64(760):318-320.	Review/Other-Tx	17 patients	To evaluate the role of PCN in malignant ureteric obstruction.	Renal function improved in 88%. Mean survival was 18 weeks. Minor complications in 58%. Bilateral tubes confer no benefit over unilateral ones.	4
33. Emmert C, Rassler J, Kohler U. Survival and quality of life after percutaneous nephrostomy for malignant ureteric obstruction in patients with terminal cervical cancer. <i>Arch Gynecol Obstet</i> 1997; 259(3):147-151.	Review/Other-Tx	24 consecutive patients	To evaluate QOL impact of nephrostomy drainage in patients with terminal cervical cancer.	Mean survival is 5.6 months. 11/17 patients with extensive primary cancer and local lymph node involvement had acceptable QOL for 2 months or more.	4
34. Shekarriz B, Shekarriz H, Upadhyay J, et al. Outcome of palliative urinary diversion in the treatment of advanced malignancies. <i>Cancer</i> 1999; 85(4):998-1003.	Observational-Tx	103 patients	Retrospective study to evaluate survival and performance status after palliative diversion in patients with advanced malignancies.	Primary endourologic procedures had high failure rates. 51% required secondary percutaneous procedures. Most patients had poor performance status after decompression.	2
35. Watkinson AF, A'Hern RP, Jones A, King DM, Moskovic EC. The role of percutaneous nephrostomy in malignant urinary tract obstruction. <i>Clin Radiol</i> 1993; 47(1):32-35.	Observational-Tx	50 consecutive patients	Retrospective study to establish a protocol for selection of patients with abdominopelvic malignancy most likely to benefit from nephrostomy for renal obstruction.	Four groups: Group I, renal obstruction caused by a nonmalignant complication as a result of previous surgery or radiotherapy (n=8); Group II, renal obstruction due to untreated primary malignancy (n=16); Group III, renal obstruction from relapsed disease with a viable treatment option (n=8); and Group IV, relapsed disease with no conventional treatment option (n=18). There was significant benefit from PCN in Groups I-III. The overall median survival time of Group IV patients was extremely poor: 38 days (range 6-143 days) with no long-term survivors. No worthwhile benefit is obtained if nephrostomy is used as a palliative measure in the absence of definitive treatment.	2
36. Chiou RK, Chang WY, Horan JJ. Ureteral obstruction associated with prostate cancer: the outcome after percutaneous nephrostomy. <i>J Urol</i> 1990; 143(5):957-959.	Observational-Tx	37 patients	Retrospective study to evaluate outcome of ureteric obstruction from prostate cancer when treated with PCN.	Survival was 57% at 1-year, 29% at 2-years. 1 and 2-year survival rates of 15 patients (no prior hormonal therapy) were 73% and 47%, respectively, while those of patients who had previously received hormonal therapy were 48% and 19%, respectively. Severe renal failure improved in 9/12. PCN is safe and effective.	2

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37. Guz B, Stroom SB, Novick AC, et al. Role of percutaneous nephrostomy in patients with upper urinary tract transitional cell carcinoma. <i>Urology</i> 1991; 37(4):331-336.	Review/Other-Tx	21 patients; 23 renal units	To evaluate role of PCN in patients with upper urinary tract transitional cell carcinoma.	Complications were few and seeding of the tract or local tumor spread has not occurred at follow-up ranging from 1-121 (mean 27.8) months. PCN is an effective and safe procedure for select patients with upper tract transitional cell carcinoma.	4
38. Lienert A, Ing A, Mark S. Prognostic factors in malignant ureteric obstruction. <i>BJU Int</i> 2009; 104(7):938-941.	Observational-Tx	49 patients	To validate a model to stratify patients with obstructive nephropathy due to malignant ureteric obstruction associated with a poor prognosis, into different prognostic groups, as a recent report identified low serum albumin, degree of hydronephrosis and number of events related to metastatic disease as prognostic indicators before palliative decompression.	Tumors were of urological origin in 66% of patients. Patients with prostate cancer had nephrostomy tubes indwelling for a mean of 279 days vs 190 days (P=0.07) for patients with tumors not of prostatic origin. A serum albumin level of >30 g/L (P≤0.001), serum sodium <135 mmol/L (P=0.019) and three or more events related to dissemination of cancer (P=0.04) were factors associated with a significantly shorter mean survival. Complications related to the nephrostomy tube were experienced by 39% of patients. The model proved useful in stratifying these patients into different risk groups (P=0.002).	2
39. Nariculam J, Murphy DG, Jenner C, et al. Nephrostomy insertion for patients with bilateral ureteric obstruction caused by prostate cancer. <i>Br J Radiol</i> 2009; 82(979):571-576.	Review/Other-Tx	25 patients	To identify whether bilateral PCN insertion confers any advantage over unilateral PCN insertion for patients with bilateral ureteric obstruction.	In a cohort of 25 patients, 18 underwent bilateral and 7 underwent unilateral PCN insertion. The mean survival time following PCN was 7.5 months for all patients. The data suggest that the nadir serum creatinine after PCN insertion was similar, independent of whether one or two nephrostomies were inserted. There was also little difference in the serum creatinine levels at the time of death, suggesting that survival after PCN insertion is based on the aggressiveness of the prostate cancer as opposed to the number of nephrostomies inserted.	4
40. Kraemer PC, Borre M. [Relief of upper urinary tract obstruction in patients with cancer of the prostate]. <i>Ugeskr Laeger</i> 2009; 171(11):873-876.	Review/Other-Tx	51 journals; 237 procedures	Retrospectively review prostate cancer patients and summarize the use of different kinds of catheters.	Malignant extrinsic ureteral obstruction in prostate cancer patients is frequent and both types of relief are safe and efficient. Nephrostomies should be preferred in patients who are in bad health or infected while double-J stents - especially antegrade - should be offered to healthier or stronger patients.	4

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41. Ku JH, Lee SW, Jeon HG, Kim HH, Oh SJ. Percutaneous nephrostomy versus indwelling ureteral stents in the management of extrinsic ureteral obstruction in advanced malignancies: are there differences? <i>Urology</i> 2004; 64(5):895-899.	Observational-Tx	148 patients; PCN (n=80) or IUS (n=68)	Retrospective analysis to compare the complications and morbidities after placement of a PCN tube or an IUS in the management of malignant ureteral obstruction in patients with advanced malignancy.	Accumulated incidence of fever and acute pyelonephritis was not different in the two groups. The accumulated incidence and the incidence of febrile episodes in the IUS group was 10.3% and 0.0004/100 person-days; the corresponding values for the PCN group were 15.0% and 0.2154/100 person-days. The incidence of acute pyelonephritis in the IUS and PCN groups was 0.0002/100 person-days and 0.0005/100 person-days, respectively.	2
42. Mandal AK, Sharma SK, Goswami AK, Hemal AK, Indudhara R. The use of percutaneous diversion during pregnancy. <i>Int J Gynaecol Obstet</i> 1990; 32(1):67-70.	Review/Other-Tx	3 patients (2 patients with infected hydronephros and one with calculus anuria)	To evaluate percutaneous diversion during pregnancy.	Maintenance of percutaneous diversion allowed continuation of pregnancy to term and effectively preserved renal function.	4
43. Peer A, Strauss S, Witz E, Manor H, Eidelman A. Use of percutaneous nephrostomy in hydronephrosis of pregnancy. <i>Eur J Radiol</i> 1992; 15(3):220-223.	Review/Other-Tx	4 pregnant women	To evaluate the use of PCN in hydronephrosis of pregnancy.	The procedure provided rapid relief from pain and pyosepsis, and allowed uneventful continuation of the pregnancy to full-term, with preservation of renal function.	4
44. Trehwella M, Reid B, Gillespie A, Jones D. Percutaneous nephrostomy to relieve renal tract obstruction in pregnancy. <i>Br J Radiol</i> 1991; 64(761):471-472.	Review/Other-Tx	1 case	Describe role of PCN in hydronephrosis decompression in pregnancy.	PCN is successful in relieving clinical symptoms.	4
45. vanSonnenberg E, Casola G, Talner LB, Wittich GR, Varney RR, D'Agostino HB. Symptomatic renal obstruction or urosepsis during pregnancy: treatment by sonographically guided percutaneous nephrostomy. <i>AJR</i> 1992; 158(1):91-94.	Review/Other-Tx	7 pregnant women (5 pyonephrosi, 2 obstructed transplants)	To evaluate role of US guided PCN in pregnant women with hydronephrosis.	Prompt clinical improvement in all patients. Sonographically guided PCN is effective and safe method for pregnant women with symptomatic obstructive hydronephrosis associated with either pyosepsis or azotemia.	4
46. Kavoussi LR, Albala DM, Basler JW, Apte S, Clayman RV. Percutaneous management of urolithiasis during pregnancy. <i>J Urol</i> 1992; 148(3 Pt 2):1069-1071.	Review/Other-Tx	6 pregnant women	To evaluate the role of PCN for treatment of urolithiasis during pregnancy.	All 6 women had uncomplicated vaginal deliveries of healthy newborns and are currently asymptomatic with no evidence of obstruction. Percutaneous drainage of an acutely obstructed kidney in a pregnant woman is an effective temporizing alternative to ureteral stent placement until definitive treatment can be performed.	4

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47. Khoo L, Anson K, Patel U. Success and short-term complication rates of percutaneous nephrostomy during pregnancy. <i>J Vasc Interv Radiol</i> 2004; 15(12):1469-1473.	Review/Other-Tx	8 patients	Retrospectively study the outcome of PCN creation during pregnancy.	Regular catheter flushing is recommended and early ureteroscopic inspection and stone extraction with or without ureteral stent implantation is preferred to long-term nephrostomy. Regular flushing is advised if the nephrostomy catheter is left in situ until delivery. 1/8 patients (12.5%) in study developed significant postprocedural sepsis and 2/8 births were premature. The possibility of increased risk of septic complications and preterm birth after PCN during pregnancy requires further study.	4
48. LeRoy AJ, May GR, Bender CE, et al. Percutaneous nephrostomy for stone removal. <i>Radiology</i> 1984; 151(3):607-612.	Review/Other-Tx	700 patients	To evaluate the role of PCN in stone removal. Series of PCN placements were reviewed.	Ease or complexity of stone removal depended upon precise PCN placement. PCN placement was successful in 716/720 kidneys (99.4%) referred for percutaneous renal or ureteral calculus removal.	4
49. Picus D, Weyman PJ, Clayman RV, McClellan BL. Intercostal-space nephrostomy for percutaneous stone removal. <i>AJR</i> 1986; 147(2):393-397.	Review/Other-Tx	50 patients	To evaluate intercostals PCN access for percutaneous stone removal and describe its advantages and complications.	Complications in 12%: pleural effusion and pneumothorax. Higher risk than infracostal approach, but allows stone removal.	4
50. Lee WJ, Badlani GH, Smith AD. Percutaneous nephrostomy for endopyelotomy. <i>AJR</i> 1987; 148(1):189-192.	Review/Other-Tx	38 patients	To evaluate role of PCN and endopyelotomy. Patients (aged 7 to 79 years) underwent endopyelotomy for ureteropelvic junction obstruction over a 2 year period.	In selected patients, endopyelotomy seems superior to open pyelotomy.	4
51. Greenstein A, Kaver I, Chen J, Matzkin H. Does preoperative nephrostomy increase the incidence of wound infection after nephrectomy? <i>Urology</i> 1999; 53(1):50-52.	Observational-Tx	31 patients	Retrospective study to determine whether patients with nephrostomy who had simple nephrectomy had more postoperative complications than patients who underwent the same procedure but without nephrostomy.	7 (31.8%) of the 22 patients without nephrostomy (group 1) had wound infection compared with 7 (77.7%) of the 9 patients with nephrostomy (group 2) (P<0.05). All 9 group 2 patients had infected urine compared with 11 of the 22 in group 1 (P<0.05).	2
52. Bodner L, Noshier JL, Siegel R, Russer T, Cummings K, Kraus S. The role of interventional radiology in the management of intra- and extra-peritoneal leakage in patients who have undergone continent urinary diversion. <i>Cardiovasc Intervent Radiol</i> 1997; 20(4):274-279.	Review/Other-Tx	37 consecutive patients	To evaluate role of interventional radiology decompression in patients with post-op leaks from continent urinary diversions.	7 patients required radiologic intervention. Intervention in the form of drainage catheter manipulation (n=4), PCN (n=4), or ureteral stent placement (n=2) resulted in cessation of leakage without surgical intervention in all seven patients. Leaks can frequently be controlled with PCN and/or percutaneous fluid drainage.	4

**Radiologic Management of Urinary Tract Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
53. Lask D, Abarbanel J, Luttwak Z, Manes A, Mukamel E. Changing trends in the management of iatrogenic ureteral injuries. <i>J Urol</i> 1995; 154(5):1693-1695.	Review/Other-Tx	44 (24 treated by immediate reconstructive surgery and 20 treated by PCN tube)	Comparative study to evaluate nephrostomy vs. immediate reconstruction in setting of ureteral injury at surgery.	Primary management with nephrostomy decreases need for reoperation and usually enables spontaneous recovery.	4
54. al-Ali M, Haddad LF. The late treatment of 63 overlooked or complicated ureteral missile injuries: the promise of autotransplantation. <i>J Urol</i> 1996; 156(6):1918-1921.	Review/Other-Tx	63 consecutive patients	Review the treatment of patients with ureteral injuries that were missed during or after complicated primary surgery.	Leakage, internal or external, ceased in all 46 patients who underwent nephrostomy, of whom 20 (44%) had a patent ureter after 3 to 8 weeks and no further reconstruction was needed. When treating fistulas, urinomas, urinary ascites and obstruction due to a missed ureteral injury or a complication of the primary operation, the best results are achieved with initial nephrostomy followed by reconstruction when needed. Nephrostomy was a definitive treatment in 44% of cases with leakage and it protected any required reconstruction.	4
55. Fontaine AB, Nijjar A, Rangaraj R. Update on the use of percutaneous nephrostomy/balloon dilation for the treatment of renal transplant leak/obstruction. <i>J Vasc Interv Radiol</i> 1997; 8(4):649-653.	Observational-Tx	61 patients	Retrospective evaluation of the efficacy of PCN and nephroureteral stent placement for treatment of post-transplant ureteral leak, and PCN and balloon dilation for treatment of post-transplant ureteral obstruction.	PCN is very effective in improving renal function in patients with early obstruction. It is moderately successful in treating ureteral leak. Ureteral balloon dilatation is moderately effective for treatment of obstruction in the early (<3 months) postoperative period. However, balloon dilation is minimally successful in curing ureteric obstruction occurring more than 3 months after transplantation.	2
56. Bosma RJ, van Driel MF, van Son WJ, de Ruiter AJ, Mensink HJ. Endourological management of ureteral obstruction after renal transplantation. <i>J Urol</i> 1996; 156(3):1099-1100.	Review/Other-Tx	31 patients	To evaluate endourologic interventions (JJ stent and PCN) in post transplant obstructions.	Both JJ stent and PCN can help avoid reconstructive surgery. No definite advantage of either JJ stent or PCN.	4

**Radiologic Management of Urinary Tract Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
57. Goldstein I, Cho SI, Olsson CA. Nephrostomy drainage for renal transplant complications. <i>J Urol</i> 1981; 126(2):159-163.	Review/Other-Tx	317 (204 cases of ureteral extravasation or fistula and 113 cases of ureteral obstruction)	Review the role of PCN as part of treatment for transplant kidney ureteral complications.	Surgical repair of ureteral injuries failed in 204 cases (30.9%). 86.7% (85 cases) occurred in patients without nephrostomy compared to 13.3% (13 cases) in patients with nephrostomy. Use of nephrostomy in transplant patients with ureteral extravasation, fistulas or ureteral obstruction is encouraged strongly to optimize patient and renal unit survival.	4
58. Hyppolite JC, Daniels ID, Friedman EA. Obstructive uropathy in gynecologic malignancy. Detrimental effect of intraureteral stent placement and value of percutaneous nephrostomy. <i>ASAIO J</i> 1995; 41(3):M318-323.	Observational-Tx	41 patients	Retrospectively review records of patients with obstructive uropathy and gynecologic malignancy to determine treatment, including indications for dialysis, and outcomes.	Study shows that: intraureteral stent catheter placement predisposes to urosepsis and should be avoided; bilateral nephrostomy placement allows significant improvement in renal function, and is superior to either unilateral nephrostomy placement or combination nephrostomy-stent catheter placement; and dialysis is rarely applied to this population.	2
59. Ramsey S, Robertson A, Ablett MJ, Meddings RN, Hollins GW, Little B. Evidence-based drainage of infected hydronephrosis secondary to ureteric calculi. <i>J Endourol</i> 2010; 24(2):185-189.	Review/Other-Dx	N/A	To conduct a PubMed and Medline search on evidence based drainage of infected hydronephrosis secondary to ureteric calculi.	Two randomized trials have compared retrograde stent insertion with PCN with one trial reporting specifically on patients with acute sepsis and obstruction. Neither trial showed one superior modality of decompression in effecting decompression and resolution of sepsis. A further literature search regarding the complications of PCN and stent insertion was carried out. An overall major complication rate from PCN insertion was found to be 4%, although the complication rates from stent insertion are less consistently reported.	4
60. Hawkins IF, Jr. Retrograde percutaneous nephrostomy. <i>Crit Rev Diagn Imaging</i> 1987; 27(2):153-165.	Review/Other-Tx	Over 200 cases	Describe retrograde PCN. Retrograde approach was used in over 200 cases without any complications directly attributable to the nephrostomy.	Retrograde approach is safer, more reliable and less time consuming than the antegrade approach, especially in nondilated pelvicalyceal system.	4
61. Spirnak JP, Resnick MI. Retrograde percutaneous nephrostomy. <i>Urol Clin North Am</i> 1988; 15(3):393-397.	Review/Other-Tx	N/A	Review retrograde PCN.	Retrograde PCN can be performed in a non-dilated collecting system and can result in more accurate and less traumatic puncture. Technical alternative to antegrade PCN.	4

**Radiologic Management of Urinary Tract Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
62. Desgrandchamps F, Cussenot O, Meria P, Cortesse A, Teillac P, Le Duc A. Subcutaneous urinary diversions for palliative treatment of pelvic malignancies. <i>J Urol</i> 1995; 154(2 Pt 1):367-370.	Review/Other-Tx	21 patients	To evaluate success of pyelovesical bypass and anterior cutaneous nephrostomy (as alternative to PCN) in patients with pelvic malignancies.	Extra-anatomic urinary diversions are feasible alternatives to permanent palliative PCNs.	4
63. Aminsharifi A, Taddayun A, Jafari M, Ghanbarifard E. Pyelovesical bypass graft for palliative management of malignant ureteric obstruction: optimizing the technique by percutaneous access to the bladder using a split Amplatz sheath. <i>Urology</i> 2010; 76(4):993-995.	Review/Other-Tx	2 cases	To introduce a simple modification to the original technique of pyelovesical bypass graft placement to make the procedure more minimally invasive.	Both patients tolerated the procedures well with no intra- and postoperative complications. Renal function remained stable during the follow-up period with acceptable urine output through the urethra. Abdominal wall complications such as fistula formation or pain along the subcutaneous tract as well as stent encrustation did not occur during the follow-up period.	4
64. Coddington CC, Thomas JR, Hoskins WJ. Percutaneous nephrostomy for ureteral obstruction in patients with gynecologic malignancy. <i>Gynecol Oncol</i> 1984; 18(3):339-348.	Review/Other-Tx	6 cases	To describe the role of PCN in malignant gynecological obstructions using six illustrative cases.	Nonoperative technique of PCN allows placement of either an external nephrostomy tube or an IUS under local anesthesia.	4
65. Lynch MF, Anson KM, Patel U. Current opinion amongst radiologists and urologists in the UK on percutaneous nephrostomy and ureteric stent insertion for acute renal unobstruction: Results of a postal survey. <i>BJU Int</i> 2006; 98(6):1143-1144.	Review/Other-Tx	153 radiologists and 132 endourologists	Results of a postal survey to identify the current opinions of radiologists and urologists in the UK on PCN and ureteric stent insertion for acute renal unobstruction. Questionnaire was sent to 153 radiologists and 132 endourologists.	There were areas of strong consensus, as in clinical scenarios of ‘clinical sepsis’ or ‘elevated creatinine and potassium’, where there was 90%–100% agreement amongst all clinicians on the need for unobstruction. However, when considering, (eg, ‘ureteric obstruction with hydronephrosis with advanced malignancy for palliation’) only half of all respondents thought that unobstruction was indicated, highlighting the difficulties faced in this contentious scenario. The strongest divergence was that urologists favored PCN more often than radiologists (mean, median and range of percentage preference for PCN were 48% vs 69%, 49% vs 74%, and 6%-100% vs 18%-100% for radiologists vs urologists, respectively; P<0.001, unpaired t-test). Stents were preferred by urologist only in patients with uncomplicated benign disease and in those with coagulopathy.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
66. Yates DR, Mehta SS, Spencer PA, Parys BT. Combined antegrade and retrograde endoscopic retroperitoneal bypass of ureteric strictures: a modification of the 'rendezvous' procedure. <i>BJU Int</i> 2010; 105(7):992-997.	Review/Other-Tx	7 patients	To evaluate treating complicated iatrogenic ureteric strictures with a combined antegrade and retrograde endoscopic retroperitoneal bypass technique, a modification of the so-called 'rendezvous' procedure.	All 7 'rendezvous' procedures were successful and a ureteric stent was inserted across or around the stricture in all cases. 5/7 patients whose follow-up was >6 months had their stent removed successfully. At a median follow-up of 21 months, all patients are alive and none has required subsequent surgery. 6/7 patients presented with significant symptoms and they are all currently symptom-free, which we consider to be a successful clinical outcome. No patient has developed significant renal impairment (estimated glomerular filtration rate (<30 mL/min) but we could only confirm successful unequivocal renographic drainage in one patient.	4
67. Chitale S, Raja V, Hussain N, et al. One-stage tubeless antegrade ureteric stenting: a safe and cost-effective option? <i>Ann R Coll Surg Engl</i> 2010; 92(3):218-224.	Review/Other-Tx	98 patients	To assess the outcome of primary, one-stage antegrade ureteric stenting and to compare its safety and efficacy with the conventional two-stage approach.	A one-stage approach was found to be suitable in most cases with many advantages over the two-stage approach with comparable or better outcomes at lower costs.	4
68. Modi AP, Ritch CR, Arend D, et al. Multicenter experience with metallic ureteral stents for malignant and chronic benign ureteral obstruction. <i>J Endourol</i> 2010; 24(7):1189-1193.	Review/Other-Tx	76 stents in 59 renal units (40 patients)	To review the clinical experience with this stent for malignant or benign chronic ureteral obstruction.	Creatinine value follow-up on 54 renal units showed 20 (37%) units to have stable, 15 (28%) improved, and 19 (35%) with worsening values. No stent showed encrustation on plain radiography despite it being seen on two during direct visualization. Three stents needed operative removal with either percutaneous nephrolithotomy or cystolitholapaxy. 15/41 (37%) metallic stents placed because of an obstructed plastic stent also became obstructed. At last follow-up, 6 of 40 patients were kept from nephrostomy tubes because of the metallic stent.	4
69. Chalmers N, Jones K, Drinkwater K, Uberoi R, Tawn J. The UK nephrostomy audit. Can a voluntary registry produce robust performance data? <i>Clin Radiol</i> 2008; 63(8):888-894.	Review/Other-Tx	3262 patients	Multicenter study. To investigate the effectiveness of the Royal College of Radiologists Audit Sub-Committee's national prospective registry of PCN, which enables participants to audit their practice and compare performance with predetermined standards.	A satisfactory level of performance was achieved with an overall technical success rate of 98% and a complication rate of 6.3%. Significant risk factors for complications included rigors, anaemia, and impaired renal function. Low frequency operators were shown to have a lower technical success rate and a higher complication rate than high frequency operators.	4

Radiologic Management of Urinary Tract Obstruction
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
70. Montvilas P, Solvig J, Johansen TE. Single-centre review of radiologically guided percutaneous nephrostomy using "mixed" technique: success and complication rates. <i>Eur J Radiol</i> 2011; 80(2):553-558.	Review/Other-Tx	353 patients	A review of complication and success rates of the "mixed" technique in PCN using both the Seldinger and one-step techniques in dilated and non-dilated systems.	All of the 500 nephrostomies were successful within 24hours (96.2% primary; 3.8% postponed). The success rate of primary nephrostomy in dilated and non-dilated systems was 98.2% and 82%, respectively. Major complications occurred in 0.45% and minor complications in 14.2%.	4
71. Sommer CM, Huber J, Radeleff BA, et al. Combined CT- and fluoroscopy-guided nephrostomy in patients with non-obstructive uropathy due to urine leaks in cases of failed ultrasound-guided procedures. <i>Eur J Radiol</i> 2011; 80(3):686-691.	Review/Other-Tx	18 patients	To report combined CT- and fluoroscopy-guided nephrostomy in patients with non-obstructive uropathy due to urine leaks in cases of failed US-guided procedures.	Procedural success was 91%. Major and minor complication rates were 9% (one septic shock and one perirenal abscess) and 9% (one perirenal haematoma and one urinoma), respectively. 30-day mortality rate was 6%. Number of CT-views and needle passes were 9.3+/-6.1 and 3.6+/-2.6, respectively. Duration of the complete procedure was 87+/-32 min. Dose-length product and dose-area product were 1.8+/-1.4 Gy cm and 3.9+/-4.3 Gy cm ² , respectively.	4
72. Ramchandani P, Cardella JF, Grassi CJ, et al. Quality improvement guidelines for percutaneous nephrostomy. <i>J Vasc Interv Radiol</i> 2003; 14(9 Pt 2):S277-281.	Review/Other-Tx	N/A	Guidelines for PCN.	Underwent rigorous SIR review process following National Guidelines Clearinghouse evidence based guidelines criteria.	4
73. Gray RR, So CB, McLoughlin RF, Pugash RA, Saliken JC, Macklin NI. Outpatient percutaneous nephrostomy. <i>Radiology</i> 1996; 198(1):85-88.	Observational-Tx	48 patients; 60 PCN procedures	Retrospective review of data to evaluate role of PCN as an outpatient procedure in a select group of patients.	100% technical success. In appropriately selected patients, 88% of PCNs can be done without hospitalization. Outpatient PCN is feasible and safe and yields major cost savings.	3
74. von der Recke P, Nielsen MB, Pedersen JF. Complications of ultrasound-guided nephrostomy. A 5-year experience. <i>Acta Radiol</i> 1994; 35(5):452-454.	Review/Other-Tx	159 patients; 285 US-guided nephrostomy procedures	Retrospective evaluation of US-guided PCN complications.	Technical success rate of 92%. 33 catheters dislodged within 10 days. Other complications in 6.7% of procedures. US-guided nephrostomy is a gentle procedure with few major complications, but the risk of the procedure should still be weighed against the expected benefit.	4

Radiologic Management of Urinary Tract Obstruction
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
75. Kariniemi J, Sequeiros RB, Ojala R, Tervonen O. MRI-guided percutaneous nephrostomy: a feasibility study. <i>Eur Radiol</i> 2009; 19(5):1296-1301.	Review/Other-Dx	8 patients	To assess the feasibility and safety of MRI-guided PCN in an open-configuration low-field MRI system.	7/8 nephrostomies were successfully performed under MRI guidance. All PCN procedures in dilated renal collection systems were successful; however, nephrostomy catheter could not be placed in a nondilated system. The mean time needed for the MRI-guided PCN was 26 min. No major complications occurred during the procedure or follow-up. MRI-guided PCN in dilated renal collection system is feasible and safe. The presented technique has limitations that necessitate further technical developments before the procedure can be applied to nondilated kidneys and recommended for routine clinical use.	4
76. Vehmas T, Kivisaari L, Mankinen P, et al. Results and complications of percutaneous nephrostomy. <i>Ann Clin Res</i> 1988; 20(6):423-427.	Review/Other-Tx	181 patients	To evaluate the results and complications of PCN in a series of patients treated with PCN.	Clinical improvement in 68% of patients. Major complications in 16% (5.5% major, 10.5% minor). Benefit of PCN was closely related to the existing renal recovery potential following the relief of obstruction.	4
77. Barbaric ZL. Percutaneous nephrostomy for urinary tract obstruction. <i>AJR</i> 1984; 143(4):803-809.	Review/Other-Tx	N/A	To review the role and technique of PCN.	PCN is widely used in a variety of indications. PCN is a valuable procedure for providing temporary or permanent urinary diversion of an obstructed upper urinary tract.	4
78. Cronan JJ, Dorfman GS, Amis ES, Denny DF, Jr. Retroperitoneal hemorrhage after percutaneous nephrostomy. <i>AJR</i> 1985; 144(4):801-803.	Review/Other-Tx	57 patients; 62 kidneys	Prospective study to evaluate patients undergoing PCN for evidence of subcapsular, perirenal, or pararenal hemorrhage by CT.	Unsuspected retroperitoneal hematomas detected in 8 kidneys (13%) with CT. PCN has a low rate of associated bleeding and hematoma formation.	4
79. Gavant ML, Gold RE, Church JC. Delayed rupture of renal pseudoaneurysm: complication of percutaneous nephrostomy. <i>AJR</i> 1982; 138(5):948-949.	Review/Other-Tx	1 case	Report a case of traumatic renal artery pseudoaneurysm following PCN with delayed rupture into the collecting system.	Patient made excellent progress. Follow-up arteriography revealed a small midrenal infarction and lower pole changes secondary to pararenal infection. The nephrostomy was replaced with a double pigtail internal stent. The patient still had good renal function without hypertension 9 months after initial admission.	4

**Radiologic Management of Urinary Tract Obstruction
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
80. Cope C, Zeit RM. Pseudoaneurysms after nephrostomy. <i>AJR</i> 1982; 139(2):255-261.	Review/Other-Tx	225 patients; 300 PCNs	Review incidence and treatment of renal artery pseudoaneurysms in the setting of PCN.	Recurrent bleeding associated with renal arterial pseudoaneurysms was noted in 3/300 PCNs. Study recommends that after nephrostomy, patients who have significant continuous or recurrent bleeding of longer than 4-5 days be considered for angiography and possible arterial embolization to prevent serious progressive clinical deterioration.	4
81. Harris RD, Walther PC. Renal arterial injury associated with percutaneous nephrostomy. <i>Urology</i> 1984; 23(2):215-217.	Review/Other-Tx	1 case	To describe a case on pseudoaneurysm and subcapsular hematoma as a complication (renal artery pseudoaneurysm) of PCN.	CT is recommended in such cases using intravenous radiographic contrast material whenever possible to identify the potential bleeding site rapidly.	4
82. Miller GL, Summa J. Transcolonic placement of a percutaneous nephrostomy tube: recognition and treatment. <i>J Vasc Interv Radiol</i> 1997; 8(3):401-403.	Review/Other-Tx	1 case	Report a case on nephrocolic fistula complicating PCN drainage and outline the principles of percutaneous management that were used successfully in patient.	Complication can be managed with tube placement and placement of a second nephrostomy catheter.	4
83. Goldberg SD, Gray RR, St Louis EL, Mahoney J, Jewett MA, Keresteci AG. Nonoperative management of complications of percutaneous renal nephrostomy. <i>Can J Surg</i> 1989; 32(3):192-195.	Review/Other-Tx	350 patients	To evaluate nonoperative management of PCN complications.	Complications requiring intervention in <2%. Open surgery in <0.5%. Complications managed conservatively included splenic puncture, false aneurysm, and laceration of the renal artery, arteriovenous fistula, hemorrhage requiring transfusion, pneumothorax-empyema, urinoma, septic shock and the hemolysis-hyponatremia-renal shutdown syndrome.	4
84. Martin E, Lujan M, Paez A, Bustamante S, Berenguer A. Puncture of the gall bladder: an unusual cause of peritonitis complicating percutaneous nephrostomy. <i>Br J Urol</i> 1996; 77(3):464-465.	Review/Other-Tx	1 case	A case report on an unusual complication of PCN. A 78-year-old white man with a brief history of prostate carcinoma (T4N1M1b) and a right nephrostomy tube in place was referred to the emergency ward for pain control.	Gallbladder puncture with bile leakage can occur in otherwise seemingly uneventful PCN procedures.	4
85. Sengupta S, Harewood L. Transitional cell carcinoma growing along an indwelling nephrostomy tube track. <i>Br J Urol</i> 1998; 82(4):591.	Review/Other-Tx	1 case	A case report on a complication (tumor growth along tube tract). Case is a 78-year-old man with an indwelling PCN that had been repeatedly obstructing over 9 months, causing pain and sepsis and necessitating a change of tube.	Tumor growth along tube tract is possible. Need for caution in using an indwelling PCN in patients with high grade urothelial malignancy.	4
86. Watson G. Problems with double-J stents and nephrostomy tubes. <i>J Endourol</i> 1997; 11(6):413-417.	Review/Other-Tx	N/A	Review problems associated with double-J stents and nephrostomy tubes.	Problems occur with both double J and percutaneous catheters. No stent is totally resistant to encrustation, and frequent changes are required.	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

CI = Confidence interval

CT = Computed tomography

IUS = Internal ureteral stent

MRI = Magnetic resonance imaging

OS = Overall survival

PCN = Percutaneous nephrostomy

QOL = Quality of life

US = Ultrasound