

Study	Participants, age, gender	Participant characteristics	Intervention	Length of follow-up	Outcomes	Additional comments
El-Tabey 2005 Retrospective review Egypt	N=61 Mean age = 41.2 ± 12.5, range= 35-63 years 69% M / 31% F	1990- 2003 - Patients with BCa causing ureteral obstruction. Mean serum creatinine at presentation=11.4± 5.1, range 4.3 to 22.5. 7 patients had severe metabolic acidosis with hyperkalemia necessitating urgent haemodialysis. 95% invasive BCa, 8% ureteral invasion by tumour	All 61 patients underwent insertion of an ultrasound guided PCN tube with broad spectrum antibiotic coverage, aiming at a maximum drop on creatinine and improvement of patient's general condition. Bilateral PCN tubes were fixed starting with the better functioning side. After stabilization of kidney function, all patients underwent local tumour staging and metastatic workup. 23 patients with inoperable locally advanced bladder tumours (invading pelvic wall or rectum) were discharged with permanent PCN tubes and no further follow-up data were available. 34 patients had stage T3b or T4a bladder mass. 6 had evidence of N1 disease.	Range 8-134 months, mean 14.2 ± 9.1 months	Complications of PCN tubes, Subsequent cystectomy rates, Overall survival	
Meyer 1980 Retrospective review USA	N= 90 Gender and age not reported	1951-1976 - Patients with presumed advanced malignancy and bilateral ureteral obstruction (1951-1976). Mild to marked bilateral hydronephrosis and hydroureter in all patients except two who had prior unilateral nephrectomy. 62/90 (69%) had no visible function of at least one kidney. In 66/90 (73%) had blood urea values of 100 mg/dl or greater. 44/90 (49%) cervical cancer, 19/90 (21%) bladder cancer	83 patients underwent unilateral nephrostomy, 1 patient had bilateral nephrostomy, 3 unilateral skin ureterostomies, 3 ileal loop diversions.		Survival Complications Subsequent treatment	
Ishioka 2008 Retrospective review Japan	N=140 Median age 57 (31-85) 43% M / 57%	Between 1995-2007 patients with obstructive nephropathy secondary to advanced incurable malignant cancer. All presented with renal failure. 5 patients (4%) had no therapy before diversion. 25/110 (18%) grade 1-2 hydronephrosis, 115/140 (82%) grade 3-4 hydronephrosis. Malignancy type: 29/140 (21%) gastric, 34/140 (24%) colorectal, 30/140 (21%) cervical, 13/140 (9%) urothelial.	PCN insertion under local anaesthesia guided by ultrasonic and fluoroscopic imaging. After percutaneous puncture of the kidney with patient in the prone position, the Seldinger technique was followed to access the pelvicaliceal system and a 8Fr nephrostomy pigtail catheter was left in situ. PCN tube placement was unilateral in all patients. In the presence of bilateral obstruction the PCN tube was inserted on the side with good preservation of renal parenchymal width as confirmed by ultasonography	Not reported	Result of PCN, Overall survival.	Bladder cancer not stated. Prognostic model stratified patients into 3 risk groups.
Lienert 2009 Retrospective review New Zealand	N=52 (49 in final analysis) Median age 71 (36-91) 55% M/ 45% F	2005-2007 – All patients who had PCN tubes inserted due to malignant obstruction. 15/49 (30%) prostate, 18/49 (36%) bladder, 6/49 (12%) colorectal	Bilateral nephrostomy tubes were inserted in 23/49 (46%) patients.	Not reported	Overall survival, Complications	Validation of Ishioka prognostic risk groups.
Watkinson 1993	N=50	Patients with a history of abdominopelvic	All PCN procedures performed under local anaesthesia	Minimum 99	Overall survival	

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Retrospective review UK	25/50 (50%) Male, mean age 57 years 25/50 (50%) Female, mean age 48 years	malignancy who had undergone PCN (1981-1991). 18/50 (36%) primary bladder tumour, 16/50 (32%) cervical tumour. Patients classified into 4 groups based on cause of renal tract obstruction. Group1 (n=8): non-malignant complication from previous surgery or radiotherapy Group2 (n=16): untreated primary malignancy Group3 (n=8): relapsed malignant disease with viable treatment option Group4 (n=18): relapsed malignant disease with no conventional treatment option	using an 8.3 French pigtail catheter (Surgitech or Cook), utilizing screening facilities or grey scale ultrasonography and with routine antibiotic cover. All procedures performed by one of two operators.	days on each surviving patient		
Sheikh 2007 Retrospective review UK	N=145 Age/gender not reported	1994-2005 – patients underwent PCN and subsequent antegrade stenting for obstructive uropathy in pelvic malignancies, either at same time or a later date. Primary malignancy: 49/145 (34%) prostate, 44/145 (30%) bladder, 24/145 (17%) cervical/uterine.	145 patients had 241 stents inserted. 37/45 (26%) had simultaneous PCN and antegrade stenting. 108/145 (74%) had delayed stenting. 38/145 (26%) had unilateral stenting.	Not reported	Survival	Abstract only
Gupta 2007 Retrospective review India	N=58 Mean age 58 ±9.2 (range 42-78) Gender not reported	1998-2005 patients with stage T2 or higher bladder cancer and obstructive uropathy. Mean Scr at presentation was 9.2 ±4.5 mg% (range 2.4 – 16.5). 2 patients had immediate haemodialysis (HD) and refused further treatment, 8 underwent RC without PCN or HD. 10 patients required urgent HD before PCN. 38 underwent PCN directly. 2 died after PCN due to progressive sepsis and multi-organ failure	PCN was done under ultrasound guidance with broad spectrum antibiotic coverage. In patients with bilateral obstruction PCN was done on each side simultaneously to achieve rapid decrease in Scr. After nadir Scr was achieved bimanual examination and radiological imaging was performed for local staging and metastatic assessment. 14 patients had locally inoperable or metastatic disease or Scr failed to improve significantly. These patients were discharged with a permanent nephrostomy catheter. In these patients the standard 10Fr catheters were replaced with 18 Fr Foley catheters.	Mean 34 months (12-80)	Cystectomy PCN complications Renal function	
Vehmas 1988 Retrospective review Finland	N=181 (128 malignant) Mean age 64 (15-84) 50% M/ 50% F	1978-1987 -Two-thirds were cancer patients with urinary obstruction from primary or metastatic neoplasm. 35/128 (27%) bladder cancer, 22/128 (17%) gynaecological cancer, 20/128 (16%) prostate. Hydronephrosis diagnosed in 147 patients.	PCN - Atropine, diazepam and if needed i.v. analgesics were given as premedication. Puncture guidance initially based on fluoroscopy but later ultrasound was used. 3-day dilation was replaced by instant dilation to the intended size of the catheter. Different models of catheter were tried including straight or pigtail, Malecot catheters and balloon catheters. 15/181 (8.3%) could not be catheterised at all. Not all patients were followed up for Scr levels.	Not reported	Success of stents Complications Creatinine levels	Outcomes not reported separately for malignant/ benign obstructions
Radecka 2006 Retrospective review	N=151 Mean age 73 (51-97)	1998-2005 - Patients with malignancies causing obstruction referred for treatment with PCN. 55/151 (36%)	Bilateral PCN was performed in 42 patients. PCN performed under local anaesthesia and antibiotic cover. The kidney was punctured percutaneously and the	Median 3 years 9 months (range 1 yr 3	Survival	

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Sweden	74% M / 26% F	prostate cancer, 43/151 (28% bladder, 11/151 (7%) gynaecological, 16/151 (11%) colorectal. 16/43 (37%) terminal bladder cancer, 27/43 (63%) curable bladder cancer	Seldinger technique was followed to access the pelvocalyceal system under ultrasonic and fluoroscopic guidance. After dilation an 8.5 or 10.2 F nephrostomy tube was left in situ.	months to 7 yrs)		
Lau 1995 Retrospective review UK	N=77 Mean age 56 (24-78) 32% M / 68% F	1982-1992 – patients with newly diagnosed or previously treated pelvic malignant disease and evidence of hydronephrosis with impaired renal function. 42/77 (55%) cervical cancer, 18/77 (23%) bladder cancer. Group1 (n=31): patients with untreated primary malignant disease Group2 (n=15): recurrent malignant disease for which further treatment was available Group3 (n=12): recurrent malignant disease with no further treatment available Group4 (n=19): benign complications from previous treatment.	PCN performed under local anaesthesia with fluoroscopic or ultrasonographic guidance. Patients treated with JJ stents not included although some patients had undergone failed attempts at retrograde stenting before PCN. PCN was successfully inserted in all patients.	Not reported	Survival, changes in serum creatinine Complications	Complications not reported separately for malignant and benign obstructions.
Aravantinos 2007 Retrospective review Germany/Greece	N=270 Mean age 63 (40-86) Gender not reported	1996-2003 – patients with obstructive nephropathy caused by advanced malignancy who underwent PCN. Uremia was the main presenting symptom in 88% of participants, 12% oligoanuria. 92% bilateral obstruction. 22/270 (8%) had a solitary functioning hydronephrotic kidney. 54/270 (20%) in each group of bladder cancer, prostate, gynaecological, colorectal cancer, and 'other' including gastric, pancreatic, lymphomas. Group A: locally extended malignancy affecting the urinary system Group B: largely disseminated disease that produced obstructive nephropathy including patients with enlarged lymph nodes and distant metastases	The technique of percutaneous approach was identical in all cases. The side of nephrostomy was chosen based on parenchymal thickness demonstrated by ultrasonography. Retrograde stenting was either unsuccessful or not attempted because of anticipated complicated anatomy. PCN under local anaesthesia under ultrasonographic and fluoroscopic guidance. Initial puncture made with 17.5 gauge Chiba needle with removable trocar (usually with a free-hand technique). Then contrast was injected to confirm correct placement of the needle. A 0.035-inch Lunderquist inflexible steel guide wire with flexible tip was then inserted into the collecting system. A series of Alken metal dilators inserted over this guidewire produced a channel of up to 14 to 16F in diameter. Removed all but the initial dilators; an open-ended silicone Foley catheter was advanced over it into the pelvis and eventually removed. Catheters usually changed every 3 months.	Not reported	Overall survival Quality of life (EORTC QLQ) Creatinine levels	
Carrafiello 2006 Retrospective review Italy	N=201 (299 procedures) Mean age 66 (32-102)	All patients affected by prior malignancy. 44/299 (15%) severe (grade IV) hydronephrosis, 255/299 (85%) grade II-III hydronephrosis. 68/299 (23%) emergency procedures due to rapid worsening of renal function.	149 PCNs were on the right side and 88 on the left side. 31 patients underwent bilateral PCN. All patients had normal pre-procedure coagulation and platelet estimation. PCN under ultrasound and fluoroscopic guidance, with haemodynamic monitoring. 271/299 (91%) only local anaesthesia was used at the site of	Not reported	Complications	

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	54% M / 46% F		puncture. 28/299 (9%) i.v. sedoanalgesia was necessary to due lack of collaboration or excessive pain. 255/299 (85%) Seldinger technique, 15% one-step technique used when excretory system was very dilated (grade IV hydronephrosis). All patients received prophylactic antibiotic regimen beginning immediately before procedure and continuing for the following 4 days. 100% immediate success was obtained.			
Fallon 1980 Retrospective review USA	N=100 Age range 15-84 65% M/ 35% F	Patients with upper tract obstruction associated with invasive, incurable cancer. 37/100 (37%) prostate, 29/100 (29%) bladder, 15/100 (15%) cervical. 71 patients were azotaemic at the time of nephrostomy (blood urea >15mmol/l). 76 bilateral obstruction, 15 unilateral. 6/15 had solitary kidneys. In 80 patients some form of therapy for the primary malignancy had been given prior to the need for nephrostomy.	8 patients had emergency treatment. In 60 cases unilateral nephrostomy was performed and in 40 patients bilateral nephrostomy was done, either simultaneously or sequentially. Patients were categorised for quality of survival Group A: Patient discharged home from hospital. Little or no pain and survival of at least 2 months. Patient was generally ambulatory and alert Group B: Patient was discharged home or to a minimal care institution. Pain controlled with analgesics and there was at least a moderate limitation of activities. Group C: Patient confined to hospital requiring narcotics for pain, or a continuing decline in status.	Not reported	Survival Creatinine Quality of survival	
Ekici 2001 Retrospective review Turkey	N=23 Mean age 55 (25-76) 91% M/ 9% F	1987 -2000 - Consecutive patients who underwent PCN for ureteral obstruction associated with bladder cancer. 10 presented with oliguria, anuria, UTI or renal damage. 17 patients reported flank or abdominal pain. PCN performed in 3 patients who had recurrent malignant obstruction after cystectomy. 17 patients underwent primary PCN.	PCN performed according to standard techniques under local anaesthesia. 11/23 (48%) had unilateral obstruction. 12/23 (52%) had bilateral obstruction.	Not reported	Overall survival Creatinine Complications	
Liatsikos 2009 Retrospective review Greece	N=90 Mean age 59 (35-80) 38% M / 62% F	From 1996-2005, patients with unilateral or bilateral extrinsic malignant ureteral obstruction secondary to tumours associated with pelvic or retroperitoneal metastasis in all cases. Obstruction was related to compromised renal function, hydronephrosis and/or UTI. Primary site of disease: colon 31 ureters, ovary 29 ureters, uterus 24 ureters, prostate 22 ureters, bladder 9 ureters	Metal stents were placed percutaneously under fluoroscopic guidance through a nephrostomy tract in all cases. Antibiotic prophylaxis given 24 hours before intervention. The standard procedure for PCN was used. A 7Fr long sheath was placed in the dilated ureter to facilitate a hydrophilic guidewire through the stricture. Obstruction dilated with 6-7mm wide angioplasty balloons then standard vascular self-expandable metal stents with 8mm diameter and length of 3-12cm were applied.	1 year. Median follow-up 15 months (8 to 38)	Renal function Successful abolishment of stricture	Study was an off label application and stent brands chosen according to availability
Kinn 2003 Retrospective review	N=68 Age/gender not reported	1998-1999 68 patients with malignancy underwent PCN. The most common indication for PCN was uremia followed by hematuria and urosepsis.	A unilateral nephrostomy was usually chosen, and if the creatinine level had not dropped within 3-4 days, a catheter was introduced in the other kidney as well.	Not reported	Survival Complications	

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Sweden		38/68 (56%) prostate cancer, 20/68 (29%) bladder cancer. All prostate cancer patients were receiving hormone therapy or had ablation of testes at the time of PCN				
Ganatra 2005 Retrospective review USA	N=157 Mean age = 54.7 (23-83) 39% M / 61% F	All patients who underwent ureteral stent placement for noncalculous reasons. Direct tumour obstruction by bladder cancer was excluded. Extrinsic ureteral compression from bladder cancer lymphadenopathy was included. Patients with extrinsic ureteral compression and direct tumour invasion into the bladder from other malignancies were included. Average creatinine before stent was 2.51. Majority ovarian cancer. 2/157 bladder cancer	Retrograde internal ureteral stents were attempted in all patients (n=157) with evidence of malignant ureteral obstruction. Failure defined as an inability to place stents, or recurrent ureteral obstruction despite stent placement (increase in creatinine by 50%, or nadir, pain, infection, or hydronephrosis). Immediate failure of stent (impossible to place stent due to external compression) referred for PCN.	Mean = 13.6 months, range = 1 day to 84.3 months	Stent failure rate – immediate vs. Late failure, Progression to PCN Creatinine level, Mortality rate,	
Izumi 2011 Retrospective review Japan	N=61 Median age 64 (27-89) 31% M/ 69% F	Patients who underwent retrograde ureteral stenting for malignant ureteral obstruction (2005-2010). 21/61 (34%) gynaecologic cancers, 13/61 (21%) upper GI, 10/61 (16%) urological cancers, bladder cancer n=2.	Retrograde ureteral stent placement under x-ray guidance. Multi-length ureteral stents of 4.8 or 6Fr (Contour) were used. Interval between stent changes were initially planned at 3 months.		Overall survival Stent-failure free survival Stent-related complications	
Chung 2004 Retrospective review USA	N=101 Mean age 61 (33-90) 44% M / 56% F	Patients with extrinsic ureteral obstruction – defined as presence of confirmed hydronephrosis, and the presence of flank pain, or increased serum creatinine, or both symptomology and increased creatinine. Patients without hydronephrosis were excluded. 64/101 (63%) unilateral involvement, 37/101 (37%) bilateral involvement. 90/101 (89%) malignant cause, 11/101 (11%) benign cause. Majority colon and rectal cancer. 2 bladder cancer patients	Retrograde placement of internal ureteral stents. Data used for the first stent only for those with bilateral obstruction. Patients who underwent antegrade ureteral stent insertion after initial management with PCN were excluded. Stent failure was defined as persistent hydronephrosis with flank pain or persistently increased serum creatinine levels. Impossibility of stent placement due to severe external compression was also considered failure. PCN tubes were placed in 27 (27%) patients due to retrograde stent failure.	Mean 11 months, range 0-127	Stent failure/success	
Kamiyama 2011 Retrospective review Japan	N=53 Mean age 61 (32-92) 42% M/ 58% F	2002- 2009 - Patients who underwent retrograde ureteral stenting to decompress malignant extrinsic ureteral obstruction. 2/53 patients had antegrade stenting because it was impossible to identify the ureteral orifices. 30/53 (57%) GI cancer, 3/53 (6%) prostate, 13/53 (25%) gynaecological. 8/53 (15%) direct tumour invasion to the bladder, 18/53 (34%) peritonitis carcinomatosa, 15/53	Ureteral stenting indicated when obstruction was suspected from imaging studies. PCN selected for the patient with direct invasion of the bladder or prostate cancer, and those in poor general condition. Stent insertion was performed using a caudal block under fluoroscopic guidance. One stent was inserted per ureter without dilations of the obstructive lesion. All stents generally exchanged every 3 months. All ureteral stents were of same hydro plus coating material.	Mean 106 days (1-1627)	Stent failure – inability to place stent or recurrent obstruction. Renal function Survival	

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		(28%) local recurrence, 13/53 (24%) lymph node metastases.				
Shekarriz 1999 Retrospective review USA/Germany	N=103 (92 bilateral, 11 unilateral Median age 68 ± 12.5. Patients with bladder/ prostate cancer were significantly older. Gender not reported	Patients who underwent palliative urinary diversion (stent or PCN) for ureteral obstruction secondary to advanced malignant disease (1986-1997). 28/92 (30%) primary prostate malignancy, 25/92 (27%) bladder, 19/92 (21%) GI, 20/92 (22%) gynaecological. 14/92 (15%) had no prior therapy at time of diversion – 7 of these were deemed incurable	Endoscopic ureteral stent placement or PCN were performed according to standard techniques.		Creatinine levels, Survival, Complications, Performance status	Outcomes for stent or PCN not reported separately. Bilateral and unilateral reported separately
Chitale 2002 Retrospective review UK	N=65 Age range 53-84 years 80% M / 20% F	Patients with upper tract obstruction secondary to malignant pelvic disease. 28/65 (43%) primary prostate cancer, 30/65 (46%) bladder cancer. 46/65 (71%) renal impairment, 19/65 (29%) normal renal function. 47/65 (72%) bilateral hydronephrosis, 28% unilateral hydronephrosis. In total 105 renal units needed decompression.	Endoscopic retrograde stenting was attempted in 24/65 (37%) patients as the primary method of decompression. PCN offered to 41/65 (63%) patients. In 19/24 (79%) patients in whom retrograde stenting failed were offered PCN. Patients with nephrostomy inserted either as primary or secondary treatment procedure went on to have an antegrade stent inserted within a week of nephrostomy insertion. A second puncture was made when necessary. If the initial nephrostomy was placed in the lower calyx, a mid-calyceal puncture was performed to facilitate antegrade insertion of stent	Range 10 months to 3 years	Success/failure of stenting, mortality	Successful stenting not defined
Chang 2012 Retrospective review Taiwan	N=110 Mean age 64 years (19-89). Younger patients in ureteral stent group 43% M/ 57% F	2003-2009- 110 patients with need for unilateral or bilateral upper urinary tract diversion for at least 6 months. 56/110 (51%) benign causes, 54/110 (49%) malignant causes – mostly cervical cancer. 3 bladder cancer patients. Mean baseline serum creatinine level was higher in PCN than stent group (2.96 vs. 1.48 mg/dL). Cases of stone-related hydronephrosis were excluded.	66/110 (60%) patients with ureteral stents (86 renal units). 44/110 (40%) with PCN tubes (60 renal units). <u>Stent group:</u> 7-Fr catheters (InLay ureteral stents) under cystoscopy. <u>PCN group:</u> Radiologists performed procedure under ultrasonographic guidance. In all cases 8-Fr nephrostomy catheters were put in place. Both PCN tubes of double-J stents were kept for a maximal period of 3 months, and then replacement was required. Tubes also replaced when obstructions or infections were observed.	Not reported	Serum creatinine level, hydronephrosis,	Results for benign and malignant obstruction not reported separately
Zadra 1987 Retrospective review Canada	N=135 with unilateral (37) or bilateral (98) malignant ureteral obstruction Average age at diagnosis = 59 years 42% M / 58% F	Bilateral group: Average creatinine = 689µmol/L. Five patients lost to follow-up and five refused treatment and died within 25 days. 88 patients available for analysis. 72% pelvic malignancy (28% cervix, 17% prostate, 16% bladder).	From 1978-1981 half of the 31 patients were treated with open nephrostomy (ON). From 1982-1984 the majority of the 62 patients underwent nonoperative urinary diversion with no open nephrostomies performed. Overall 37 PCN, 23 retrograde stenting (RS), 7 antegrade stenting, 14 open nephrostomy, 8 ileal conduit, 3 cutaneous ureterostomies, 1 ureterolysis. There was no attempt to remove internal stents or permanent nephrostomy tubes	Not reported. Mean survival time for tumour type reported after at least 8 month follow up.	Renal function Survival	Diversion by RS difficult in prostatic and bladder tumours because the ureteral orifices were difficult to see or were grossly invaded by the tumour

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Hübner 1993 Retrospective review Austria	N=52 Median age 67 (43-81) 40% M/ 60% F	Patients with malignant ureteral obstruction. 15/52(29%) primary colon cancer, 13/52 (25%) bladder cancer, 9/52 (17%) cervical, 6/52 (12%) ovarian, 4/52 (8%) prostate. Indications for diversion were hydronephrosis at least grade II in all cases.	24 patients primarily treated with retrograde implantation JJ stents through the cystoscope, 28 patients PCN tubes was first therapy. In cases of unsuccessful attempted retrograde stenting a PCN tube was placed. In cases of acute deterioration of renal function due to hydronephrosis, leucocytosis, nausea, vomiting or fever, a PCN was placed primarily for reliable control of urinary output. In patients with incontinence due to either tumour dependant lower urinary tract fistulas or severe dysuria caused by tumour infiltration of the bladder, percutaneous occlusion of the ureter was performed. No general anaesthesia was required. Either local anaesthesia or intravenous sedation used. In 12 patients PCN were changed to different urinary diversions.	29 patients observed for an average 11.8 months, range 4.7-25.7 months. 25 patients followed to death for average survival of 6.1 months, range 0.3 to 13.5 months	Positive result defined as discharge from hospital for at least 8 weeks without permanent need for analgesics	
Ku 2004 Retrospective review Korea	N=148 Mean age 57 (20-84) 45% M / 55% F	All patients who underwent palliative urinary diversion for ureteral obstruction secondary to advanced malignant disease (2000-2002). Hydronephrosis detected in all patients. 20/148 (13.5%) had co-morbid diseases including hypertension, diabetes, hepatitis etc. Baseline serum creatinine =2.6 ±0.4 g/L for the IUS group versus 4.5 ± 0.6 g/L for the PCN group (p=0.003)	68 retrograde internal ureteral stent (IUS), 88 PCN tube placement. The IUS was 7F to 8F and 22cm-26cm long (Percuflex). Total indwelling period ranged from 1-42 months (mean 6.0). During follow-up the IUS or PCN tube was changed regularly in most patients, mean interval between changes was 2 months (range, 1-5). The indwelling duration and interval of change in the IUS group was significantly longer than in the PCN group.	6 months	Stent failure defined as clinical stent occlusion, recurrent episodes of acute renal colic or persistent or progressive hydronephrosis. Complications	Site of primary tumour site not reported
Wong 2007 Retrospective review Australia	N=102 Median age 62 (31-86) 44% M/ 56% F	1991-2003 - Patients who underwent decompression for malignant ureteral obstruction. 77/102 (75%) PCN, 25/102 (25%) retrograde stent. 60/102 (59%) had known metastases. 77/102 (75%) prior therapy. 39/102 (38%) preop creatinine >40. 32/102 (31%) gynaecological cancer, 30/102 (29%) urological cancer, 21/102 (21%) GI cancer. Median time for obstruction to develop from diagnosis of primary malignancy was 11 months (0-345)	Radiological antegrade stent, retrograde stent, or PCN were performed according to standard techniques by consultant urologists and radiologists. The choice of procedure first attempted was directed by patient factors (fitness for anaesthesia, bladder tumour obviating RS) and by institutional factors (availability of facilities). Antegrade stenting followed PCN when feasible. Failure of the procedure means urinary decompression was not achieved. Three patients who failed retrograde stenting went on to undergo successful PCN insertion. Internalization with antegrade stenting (AS) was attempted in 37/77 (48%) who had PCN. The other 32 patients were too unwell or died before AS. AS was successful in 21/37 (57%) defined as the patient no longer being dependant on a covering PCN.	Median 46 months	Overall survival Complications Failure of procedure	
Kanou (2007) Retrospective review Japan	N=75 Mean age 63 (36-90) 40% M / 60% F	1990-2003 – Secondary ureteral obstruction due to retroperitoneal or pelvic invasion of malignant disease. 23/75 (31%) cervical cancer, 17/72 (23%) rectal, 11/75 (15%) prostate, 4/75 (5.3%)	Obstructed ureters were stented retrogradely with 6-Fr double J catheters C-Flex or Percuflex (n=51). Those double-J catheters were custom made without venting side holes. Nephrostomies (n=24) were done percutaneously under ultrasonographic guide with either	Mean 5.7 months (5 days – 19 months)	Success of procedure Renal function Survival	

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		bladder. Cases with normal urinary excretion from one kidney was excluded.	14-Fr Malecot catheter or a nephrostomy balloon catheter. These procedures were done in the better functioning kidneys unilaterally. Most procedures done under epidural, spinal or local anaesthesia. Anaesthesia time for stenting was 41.2 mins, and 48.8 mins for PCN. 37/51 (73%) stents were successful. 14 failed stents were given PCN. A further 8 patients received PCN due to unsuccessful maintenance of stents.			
Pappas (2000) Appears prospective Greece	N=159 Mean 65.1± 15.9 (18-94) 64% M / 36% F	1994-1998 – 159 patients presenting with obstructive uropathy. 125 patients had malignant obstruction, 30 patients had benign causes. 114 patients had previous unsuccessful retrograde stent.	All PCNs performed in the radiology department under local anaesthesia. The Seldinger technique was used to access the pelvicaliceal system percutaneously under ultrasonic and fluoroscopic guidance in 154 patients. In 84 patients two different punctures were performed, one with 22-gauge needle to opacify the pelvicaliceal system and the other using an 18-gauge needle to insert a 0.0035-inch guidewire, dilate to 8F to 10F, and place the nephrostomy tube (8F in most) and the double J-catheter when needed. In 75 patients, the initial puncture was also used for the subsequent procedure. 39/48 (81%) had successful antegrade stent insertion.	Not reported	Renal function Survival Complications	Renal function and complications not reported separately for malignant and benign obstructions.
Schmidbauer 2009 Appears prospective Austria	N=52 Age/gender not reported	1999-2008 – patients with end-stage metastatic malignant disease had palliative diversion (in 12 nephrocutaneous bypass)	Subcutaneous nephro-vesical/ nephro-cutaneous bypass. For a subcutaneous bypass two F12 polyurethane tubes are placed as nephrostomy and cystostomy and connected subcutaneously. In patients with impaired bladder function the distal end of the system is diverted percutaneously in the lower abdomen to simply drain into a urostomy bag. 8/52 (15%) system had to be replaced due to occlusion after a mean 9.8 months.	Mean 12.9 months (2-57 months)	Renal function, quality of life (0=very poor, 10= excellent)	Abstract only
Monsky 2013 Prospective longitudinal study USA	N=45 consecutive patients 19 male, 24 female	Consecutive patients with malignancy-related ureteral obstruction. 14 bladder cancer, 4 prostate, 13 cervical.	Nephrostomy tubes (8.5F) – 24 tubes in 15 patients (9 bilateral and 6 unilateral), double J stents (8.5F, 22-26cm) (24 stents in 15 patients, 9 bilateral and 6 unilateral), or internal external nephroureteral stents (8.5F, 22-26cm) – 22 stents in 15 patients. Choice of tube determined by MDT. 13 patients were lost to follow-up.	90 days	Quality of life: FACT-BL Assessment of urinary symptoms. Measured at 7, 30 and 90 days after placement.	No baseline QoL measure. Number of participants in final analysis unclear.