Bibliographic Cite	Literature Type	Level of Evidence	Purpose	Population	Intervention and Outcome Measures	Results/ Recommendations	Study Limitiations
Akhavein A, Henriksen C, Syed J, et al. Prediction of single procedure success rate using S.T.O.N.E. nephrolithometry surgical classification system with strict criteria for surgical outcome. Urology. 2015;85(1):69-73.	Retrospective cohort study	low level of evidence	To evaluate the S.T.O.N.E. nephrolithometry scoring system for percutaneous nephrolithotomy using computerized tomography (CT) imaging with strict criteria for stone clearance.	The authors analyzed a cohort of 122 patients consecutively undergoing percutaneous nephrolithotomy (PCNL) from July 2010 to March 2012 at a single institution for renal stones, with all patients having pre- and post-operative CT scans to assess their stone burden. Gender distribution, mean age, American Society of Anesthesiology score, and laterality were 60 men vs 62 women, 57.2 years, 2.6, and 68 left kidney vs 54 right kidney, respectively. Mean S.T.O.N.E. nephrolithometry score was 9.5 (range, 5-13). Exclusion criteria were presence of ureteral stones and outside CT imaging not compatible with the institutional software for viewing.	Mean nephrolithometry scores for residual fragments (RFs) of 0-2, 3-4, and > 4 mm were 8.87, 9.73, and 10.79, respectively, indicating that S.T.O.N.E. nephrolithometry score correlates with PCNL success rate. Postoperative CT analysis for residual stone showed 67 (54.9%), 26 (21.3%), and 29 (23.8%) patients having 0-2, 3-4, and > 4 mm RFs, respectively. The only parameters that predicted success were stone size (S) and number of calyces with stone (N; P = .019 and P <.001, respectively). Nephrolithometry score ranged from 5 to 13 with a mean of 9.5	With use of strict CT imaging criteria for assessment of residual stone status, the S.T.O.N.E. scoring system is reproducible and predictive of treatment success. Further investigation is required to both validate this model and to determine if other predictive parameters will improve it as a predictive model.	Readers were not blinded or no comment was made about the blinding of the readers; Single reader or no inter-reader reliabiligy was calculated; Reference standard was inadequate; There was not a reference standard stated / compared to the use of post-op CT and the S.T.O.N.E. scoring system for determination of treatment success; Per the authors: "This is a single-center study using the S.T.O.N.E. score with a relatively small number of patients; however, a multicenter study has been initiated to corroborate these findings."
Azoury SC, Nagarajan N, Young A, et al. Computed Tomography in the Management of Adrenal Tumors: Does Size Still Matter? J Comput Assist Tomogr. 2017;41(4):628-32.	Retrospective cohort study	low level of evidence	The authors sought to evaluate computed tomography (CT) imaging as a predictor of adrenal tumor pathology.	216 patients who underwent unilateral adrenalectomy for an adrenal mass between January 2005 and July 2015. Median age for the group was 51 years (range 44.5–61 years), and 65% female. Patients were excluded if adrenalectomy was performed in the setting of known metastatic disease, multiple nodules, trauma, renal pathology, bilateral disease, or pheochromocytoma or if there were missing preoperative CT imaging or records that included tumor size and CT characteristics (attenuation, morphology, impression).	A retrospective review was conducted of patients who underwent unilateral adrenalectomy for an adrenal mass between January 2005 and July 2015. Tumors were classified as benign, indeterminate, or malignant based on preoperative CT findings. Of 697 patients who underwent unilateral adrenalectomy, 216 met the inclusion criteria.	Pathology was benign in 88.4%, indeterminate in 2.3%, and malignant in 9.3%, with a median tumor diameter of 2.7 cm (interquartile range, 1.7-4.1 cm) and 9.5 cm (interquartile range, 7.1-12 cm) in the benign and malignant groups, respectively (P < 0.001). Of the tumors with benign features on CT, 100% (143/143) had benign final pathology. Imaging characteristics of adrenal tumors on CT scan predict benign pathology 100% of the time. Regardless of size, when interpreted as benign on CT scan, laparoscopic adrenalectomy, if technically feasible, should be the technique used when surgery is offered, or close surveillance may be a safe alternative.	Non-consecutive recruitment; readers were not blinded or no comment was made about the blinding of the readers; single reader or no inter-reader reliability was calculated, Per the authors, "The authors recognize several limitations of this study, many of which are inherent to its retrospective design. The radiographic impressions presented in this study need to be reproducible if used to guide management. Also, the surgeons included in the study had different operative preferences and skill sets. For instance, a surgeon with more training in laparoscopic surgery may feel more comfortable performing laparoscopic resection of larger tumors or ones with malignant features and borderline advanced disease. In addition, the cases included in this study span a decade, and during this time, radiologists have become more familiar with noninvasive characterization of adrenal tumors, and at the same time, imaging resolution and CT techniques have improved. Furthermore, this study included only adrenal lesions that were resected. Therefore, not surprising, a significant proportion of the benign tumors were larger, with more than half being 4 cm or greater."
Bayrak O, Demirbas A, Doluoglu OG, et al. Is a contrast study really necessary prior to ureteroscopy? Braz J Med Biol Res. 2016;49(1):e4855.	Retrospective cohort study	low level of evidence	This study aimed to evaluate the effect of preoperative imaging techniques on the success and complication rates of ureteroscopy.	736 patients (455 males and 281 females), with a mean age of 45.5+/-15.2 years (range, 1-88 years), who underwent rigid ureteroscopic procedures for removal of ureteral stones. The study group consisted of 455 males and 281 females, with a mean age of 45.5±15.2 years (range, 1–88 years). The mean age was 45.4 years (18–81 years) in group I, 46.6 years (1–79 years) in group II, 45.9 years (8–77 years) in group III, and 42.8 years (4–76 years) in group IV, with a significant difference among the groups (P=0.009). There was no difference in localization of stones (P=0.067) or stone size (P=0.122) among the groups. Patients who had a flexible URS for ureteral stone removal were excluded.	Patients were divided into 4 groups according to the type of imaging modality used: group I, intravenous urography (n=116); group II, computed tomography (n=381); group III, computed tomography and intravenous urography (n=91), and group IV, ultrasonography and abdominal plain film (n=148). There were no differences among the groups for the rate of success or complications. After one URS session, 658 (89.4%) patients were stone-free (among groups, P=0.093). The stone-free rate after primary ureteroscopy was 87.1% in group I, 88.2% in group II, 96.7% in group III, and 89.9% in group IV. The intraoperative rate of complications was not significantly different among groups (P=0.630). The intraoperative rate of complications was 11.8% for all of the patients included in the study. The mean duration of surgery was 35.8±13.1 min and was significantly different among the groups (P=0.026). The rate of ureteral orifice dilation was significantly different among the groups (P<0.001).	Low-dose NCCT [non-contrast CT] is a reliable and safe imaging modality for diagnosis of urinary stones and evaluation of patients before URS. In addition to radiation exposure, use of extra imaging modalities in the preoperative period carries the risk for nephrotoxicity and allergic reactions. Therefore, the authors believe that contrast-enhanced imaging modalities should not be used routinely in the preoperative period, except for patients with suspicion of urinary tract abnormalities (e.g., horseshoe kidney and pelvic ectopic kidney) or obstruction (e.g., ureteropelvic or ureterovesical obstruction and ureteral stricture) in ultrasonography or NCCT. Retrograde pyelography can be performed during URS as an alternative to prior contrast-enhanced radiological exams that could avoid high radiation exposure and allergic reactions.	Readers were not blinded or no comment was made about the blinding of the readers; Single reader or no inter-reader reliability was calculated; Baseline characteristics of the control and experimental groups are different and/or there was no attempt to control for confounding effects; Per the authors: "In our study, contrast-enhanced radiological imaging was performed in 207 (28.1%) patients, but we do not know the prevalence of nephrotoxicity or allergic reactions. This is the most important limitation of our study. The reason for this lack of knowledge is the retrospective and multicenter design of our study."
Cho YY, Suh S, Joung JY, et al. Clinical characteristics and follow-up of Korean patients with adrenal incidentalomas. Korean J Intern Med. 2013;28(5):557-64.	Retrospective cohort study	low level of evidence	The authors investigated the clinical characteristics and follow-up findings of subjects with adrenal incidentalomas in a single, tertiary-care hospital in South Korea.	282 patients with asymptomatic adrenal lesions discovered incidentally by CT (age >18) who underwent radiographic and endocrinological evaluations at Samsung Medical Center in Seoul, South Korea, between January 2004 and July 2011. Of the 282 patients included, 61% were male, with an average age of 57.1 years, average BMI 25.05. Average tumor size was 2.31 cm, and most patients had 1 tumor (32 patients had multiple; 11.3%). 56% of lesions occurred on the left. 28.7% of patients had an extra-adrenal malignancy. 38% of patients were hypertensive. The majority of patients were imaged for nonadrenal symptoms (35.1%), "general check up", cancer staging, or preoperative evaluation, in order of decreasing prevalence. Mean follow up time was 23.1 months. Excluded were patients referred for imaging with signs/symptoms of adrenal disease, adrenal lesions smaller than 1.0 cm, adrenal thickening/hyperplasia, or a lack of baseline characteristics including incomplete hormonal evaluation.	All patients underwent a complete biochemical workup, including AM cortisol, urinary free cortisol, overnight dexamethasone suppression test, plasma renin, serum aldosterone, urinary VMA, metanephrines, and normetanephrines. Values were compared to thresholds recommended by the NIH for diagnosis of subclinical Cushing syndrome, pheochromocytoma, or primary hyperaldosteronism. Patients were followed for up to 12 months where possible.	The majority of cases (86.2%) were nonfunctioning adrenal tumors; Of the 39 patients with functional tumors (13.8%), 28 (9.9%) were diagnosed with subclinical Cushing syndrome, six (2.1%) with pheochromocytoma, and five (1.8%) with primary hyperaldosteronism. 45 of these patients had diagnostic confirmation by histology following surgical adrenalectomy or US guided biopsy. Two patients (0.7%) were diagnosed with adrenocortical carcinomas, and 1 patient was diagnosed with an adrenal metastasis (0.4%) from prior known lung cancer. Female gender (odds ratio [OR], 3.386; 95%con dence interval [CI], 1.611 to 7.117; p = 0.0013) and a noncontrast attenuation value of > 10 HU (OR, 2.806; 95% CI, 1.231 to 6.397; p = 0.0141) were independent risk factors for functional adrenal incidentalomas. On follow up, most patient's masses were stable in size, and those which did increase, never did so beyond 1.0 cm. Only three patients demonstrated changes in biochemical profiles. Based on these findings, initial hormonal and radiographic evaluations for adrenal incidentalomas appear to be more important than follow-up tests because functional or malignant changes are rare.	Reference standard was inadequate; limited generalizability (only Korean patients at a single center); small sample size. No discussion of diagnostic accuracy of CT at initial finding of adrenal lesions and correspondence to final diagnosis.

de Silva S, Copping R, Malouf D, et al. Frequency of Angiomyolipomas Among Echogenic Nonshadowing Renal Masses (> 4 mm) Found at Ultrasound and the Utility of MRI for Diagnosis. AJR Am J Roentgenol. 2017;209(5):1074-80.	Retrospective study	low level of evidence	The purpose of this study is to evaluate what percentage of echogenic nonshadowing renal lesions larger than 4 mm found at ultrasound are angiomyolipomas (AMLs) and to review how to diagnose AMLs, with particular emphasis on the increasing role played by MRI.	All patients with a nonshadowing echogenic focus > 4 mm seen in the renal cortex were initially selected for the study, making the number of patients included initially 256. A total of 124 patients were excluded because of a lack of follow-up imaging or histopathologic records. The remaining 132 patients were ultimately included in the study. Of these, 93 were women (70.5%) and 39 were men (29.5%). The mean age overall for women was 59 years (maximum, 86 years; minimum, 21 years; range, 65 years). For men, the mean age was 65 years (maximum, 90 years; minimum, 20 years; range, 70 years).	The study data were obtained at a single institution over a period of 45 months. Although some patients were being reviewed for specific symptoms, such as hematuria, pain, or recurrent urinary tract infections, most of the findings were incidental. Follow-up data on 158 lesions in 132 patients were available. Confirmation of diagnosis was made with follow-up imaging or with histopathologic examination.	Ninety-eight (62.0%) of the lesions were AMLs, eight (5.1%) were renal cell carcinomas, three (1.9%) were oncocytomas, 17 (10.8%) were artifacts, seven (4.4%) were fat, five (3.2%) were calculi, another eight (5.1%) were scars, and 12 (7.6%) were complicated cysts. The mean age of patients with AML was significantly lower than that of patients without AML (61.71 [SD, 13.25] years vs 68.80 [SD, 17.85] years; p = 0.005). There was a female association with AMLs (p < 0.001). Echogenic nonshadowing renal lesions larger than 4 mm seen at ultrasound should not be assumed to represent an AML without follow-up because a percentage of renal cell carcinomas will be missed. Although certain ultrasound features can be useful in differentiating an AML from a renal cell carcinoma and CT is frequently diagnostic, an understanding of MRI is important because it can potentially detect lipid-poor AMLs.	The authors note that because 124 patients were still lost to follow-up, it could have affected the results, particularly for the number of patients with RCC. Because this was a retrospective study, no assessment of specific ultrasound findings that may differentiate AML from RCC was performed. Additionally, the mean followup period of 579 days may not have been adequate in differentiating RCCs with delayed growth from AMLs, and many patients did not have pathologic proof of diagnosis; however, because this was a retrospective study, further interval surveillance data could not be obtained.
Dym RJ, Duncan DR, Spektor M, et al. Renal stones on portal venous phase contrast-enhanced CT: Does intravenous contrast interfere with detection? Abdom Imaging. 2014;39(3):526-32.	Retrospective cohort study	moderate level of evidence	To determine the sensitivity of portal venous phase contrast-enhanced CT for the detection of renal stones.	Patients who underwent both non-contrast and portal venous contrast-enhanced CT of the abdomen and pelvis which had there was at least one stone measuring greater than or equal to 1 mm in diameter in either kidney (excepting the 12 negative cases added for heterogeneity). A total of 97 cases were included (85 with nephrolithiasis) with a total of 238 stones (2.5 ± 3.2 stones per patient; 0-16). Maximum stone attenuation values ranged from 114 to 1575 HU with a mean (±SD) of 549 ± 373 HU. Stone diameter ranged from 1 to 25 mm with a mean (±SD) of 3.5 ± 3.0 mm. 178 (75%) of stones were ≥2 mm in size. Excluded were patients with a history of prior partial nephrectomy of patients with ureterolithiasis.	Non-contrast CT was reviewed as the reference standard for the presence of nephrolithiasis. Three reviewers were asked to independently rate portal venous images only for the presence and size of nephrolithiasis.	For the three reviewers, there was a combined total of 135 stones which were not detected, out of a maximum combined total of 714 stones. The mean diameter (±SD) of these undetected stones was 2.1 ± 0.75 mm with a range of 1–5 mm. There was also a combined total of 10 false-positive stones, with a mean recorded diameter (±SD) of 1.5 ± 0.66 mm and a range of 1–2.9 mm. Pooled reviewer sensitivity for renal stones <2 mm = 61%, versus 72% for <3 mm, 88% for ≥2 mm, 95% for ≥3 mm, and 99% for ≥4 mm. Contrast-enhanced CT is highly sensitive for the detection of renal stones >=3 mm in diameter and less sensitive for smaller stones. In cases where the clinical diagnosis is uncertain and performance of a CT examination is being contemplated, intravenous contrast utilization would allow assessment for stone disease while also optimizing evaluation for other conditions.	Reference standard was inadequate; possibly too few negative studies included, generating bias in that reviewers knew that the dataset was markedly enriched. Per the authors, "1. the three reviewers were all aware of the purpose of this study and were presumably meticulous in inspecting the images for stones, possibly identifying some which they may not have otherwise seen in a routine clinical review. 2. A potential limitation in the generalizability of our results relates to variability in the precise phase of imaging. All the cases selected for this series included imaging in the portal venous phase of imaging, usually corresponding to the late corticomedullary or early nephrographic phase of renal enhancement. This likely represents normal variability, however."
El-Merhi F, Mohamad M, Haydar A., et al. Qualitative and quantitative radiological analysis of non-contrast CT is a strong indicator in patients with acute pyelonephritis. Am J Emerg Med. 2018. 36(4):589-593.	Retrospective Study	low level of evidence	To evaluate the performance of non-contrast computed tomography (CT) by reporting the difference in attenuation between normal and inflamed renal parenchyma in patients clinically diagnosed with acute pyelonephritis (APN).	74 patients, admitted with a clinical diagnosis of APN and failed to respond to 48h antibiotics treatment.	Mean attenuation values in Hounsfield units (HU) were measured in the upper, middle and lower segments of the inflamed and the normal kidney of the same patient. Independent t-test was performed for statistical analysis. Image evaluation included receiver operating characteristic (ROC), visual grading characteristic (VGC) and kappa analyses.	The mean attenuation in the upper, middle and lower segments of the inflamed renal cortex was 32%, 25%, and 29% lower than the mean attenuation of the corresponding cortical segments of the contralateral normal kidney, respectively (p<0.01). The mean attenuation in the upper, middle, and lower segments of the inflamed renal medulla was 48%, 21%, and 30%, lower than the mean attenuation of the corresponding medullary segments of the contralateral normal kidney (p<0.02). The mean attenuation between the inflamed and non-inflamed renal cortex and medulla was 29% and 30% lower respectively (p<0.001). The AUCROC (p<0.001) analysis demonstrated significantly higher scores for pathology detection, irrespective of image quality, compared to clinical and laboratory results with an increased inter-reader agreement from poor to substantial. The authors conclude that non-contrast CT showed a significant decrease in the parenchymal density of the kidney affected with APN in comparison to the contralateral normal kidney of the same patient. This can be incorporated in the diagnostic criteria of APN in NCCT in the emergency setting.	Small, retrospective sample from a single center.
Hu EM, Ellis JH, Silverman SG, et al. Expanding the definition of a benign renal cyst on contrast-enhanced CT: Can incidental homogeneous renal masses measuring 21-39 HU be safely ignored? Acad Radiol. 2018; 25(2):209-212.	Retrospective study	low level of evidence	To determine the frequency and clinical significance of homogeneous renal masses measuring 21-39 Hounsfield units on contrast-enhanced computed tomography (CT).	All subjects undergoing contrast-enhanced abdominal CT from January 1, 2006 to December 31, 2010. Inclusion criteria: subject age 40–69 years, slice thickness ≤ 5 mm, no prior abdominal CT or magnetic resonance imaging (MRI), no concomitant unenhanced CT, and first eligible CT examination per subject. Subject age was restricted to 40–69 years to target the highest yield and most clinically relevant cohort. This identified 1387 CT examinations in 1387 subjects.	Images were manually reviewed by three radiologists in consensus to identify all circumscribed homogeneous renal masses (maximum of three per subject) ≥10 mm with a measured attenuation of 21–39 Hounsfield units. Exclusion criteria were known renal cancer or imaging performed for a renal indication. The primary outcome was retrospective characterization as a clinically significant mass, defined as a solid mass, a Bosniak IIF/III/IV mass, or extirpative therapy or metastatic renal cancer within 5 years' follow-up.	Eligible masses (n = 74) were found in 5% (63 of 1387) of subjects. The majority (53% [39 of 74]) was endophytic with a mean attenuation of 28 HU (21–38) and mean maximum diameter of 20 mm (10–56 mm). Of those with a reference standard (n = 42), none (0% [95% CI: 0.0%–8.4%]) were clinically significant. Of those with a clinical follow-up reference standard, the median follow-up period was 7.3 years (range: 5.0–9.1 years). The remaining 32 were never definitively characterized and lost to followup; therefore, they were not included in the primary outcome. The authors conclude that incidental renal masses on contrast-enhanced CT that are homogeneous and display an attenuation of 21–39 Hounsfield units are uncommon in patients 40–69 years of age, unlikely to be clinically significant, and may not need further imaging evaluation.	Despite manually reviewing 1387 contrast-enhanced CT scans, there was a low prevalence (5%) of homogeneous renal masses with an attenuation greater than 20 and less than 40 HU. A larger number would have refined our confidence interval. Due to the retrospective nature of this study, an eligible reference standard was only available for 42 masses. Authors intentionally excluded subjects with a personal history of renal cancer and those who were being imaged for a renal indication to isolate the study group to incidentally detected masses. Therefore, results might not apply to such patients.
Itani M, Pandya A, Bude RO. Sonographically identified echogenic renal masses up to 1 cm in size are so rarely malignant they can be safely ignored. J Ultrasound Med. 2016; 35:323-328.	Retrospective study	low level of evidence	To determine whether small echogenic renal masses up to 1 cm in size incidentally detected by sonography are rarely malignant and thus do not need further workup.	Patients with known malignancy of any kind, tuberous sclerosis, lesions larger than 1.0 cm, lesions with heterogeneous echogenicity, and lesions with posterior ring-down artifacts or posterior acoustic shadowing were excluded. The final study sample consisted of 120 echogenic renal masses of 1 cm or smaller in 111 patients. The mean patient age was 56 years (range, 22–94 years, with 100 patients >40 years) and included 79 female patients (71%) and 32 male patients (29%).	The authors reviewed approximately 13,600 reports of all abdominal sonographic examinations performed between November 2001 and October 2007 that identified a small echogenic mass in a kidney. All patients without magnetic resonance imaging or computed tomographic scans that completely characterized the lesions were excluded unless a follow-up study (sonography, magnetic resonance imaging, or contrast-enhanced computed tomography) at least 5 yrs later was available for comparison to prove that the lesion was benign. For proof of the lesion character, the 3 radiologists met in consensus to compare the index sonograms with the CT, MRI, or sonographic studies.	A total of 120 lesions in 111 patients satisfied the inclusion criteria. Lesion sizes were 0 to 5 mm (n = 16) and 6 to 10 mm (n = 104). Of these, 54 lesions were characterized as definitely benign (47 angiomyolipomas and 7 other benign entities: calcifications in stones or within a cyst or calyx and cysts that were either simple on follow-up studies or complicated with hemorrhagic or proteinaceous content). For the remaining 66 lesions, follow-up results after at least 5 years were normal in 24 cases (which meant that the lesion was no longer visible), and the remaining 42 lesions were stable in size. The mean duration of follow-up for these 66 lesions was 7.4 years. Small echogenic renal masses up to 1 cm in size that fulfill our study criteria are so likely to be benign that they can be safely ignored.	The authors note that a shortcoming of the study was its retrospective nature and our not knowing the histologic types of the echogenic lesions initially excluded because of inadequate follow-up. Another potential shortcoming was the female-to-male ratio of nearly 5:2 (79 female and 32 male) if the chances of malignancy in small echogenic masses are different for the sexes, which is something our study could not evaluate.

Kravchick S, Cherniavsky E, Verchovsky G, et al. Multidetector computed tomographic urography (MDCTU): Its practical role in diagnosis of upper tract urothelial cancer in patients 50 years and older with different types of hematuria. Pathol Oncol Res. 2019; 25(1):249-254.	Retrospective study	low level of evidence	Previous studies tried to discover in which group of patients MDCTU might be the most efficient. Based on the results of those studies, it could be presumed that the likelihood to detect of UC increases in patients ≥50-year-old who present with recurrent episodes of microhematuria or single event of gross hematuria. In this retrospective study, we attempted to assess the role of MDCTU in this group of patients, presented with different types of hematuria.	140 patients were included in this study. Mean patients' age was 69.7 ± 16.98 and there were 103 males and 37 females. Overall cancer was detected in 26 patients: UUTUC – 9 and BUC −17. The lag between MDCTU and consecutive endoscopy was 5.3 ± 1.5 weeks. Smokers and passive smokers comprised 38.6% and 26.4% of our patients, while 37.8%of our patients suffered fromDM, 28.6% were on the aspirin and 16.4% on the warfarin treatment. 32 (22.9%) of our patients presented with hematuria plus lumbar pains and/or dysuria.	To estimate the accuracy of MDCTU in the detection of upper urinary tract urothelial carcinoma (UUTUC) we compared MDCTU findings with the results of ureteroscopy.We also evaluated which factors can predict ureteroscopic confirmation of MDCTU based diagnosis. In this list we also included diabetes mellitus and anticoagulant medications.	MDCTU suspected urothelial carcinoma in 17% (n=24) of our patients: UUTUC in eight and bladder urothelial carcinoma (BUC) in 16patients. Ureteroscopy had diagnosed UUTUC (with/without concurrent urothelial carcinoma of the bladder) in 9 patients: 6 with suspicious lesions in MDCTU and 3 additional patients with CIS/small low grade TCC. MDCTU had a sensitivity of 66.7%, specificity - 98.5%, positive predictive value - 75% and negative predictive value - 97.7%. The logistic regression model revealed five strong predictors for UUTUC: positive/atypical cytology, recurrent hematuria, MDCTU signs, age and Warfarin treatment. Finally a source of hematuria was diagnosed in 57% of patients, while MDCTU individual accuracy reached 42%. We found that MDCTU can effectively identify patients in whom further endoscopy is unnecessary. Otherwise, elder patients with positive/atypical cytology and recurrent microscopic hematuria, who have MDCTU signs and take Warfarin, should undergo endoscopic evaluation.	Retrospective study, single site, no information provided on inter-rater reliability.
Lou I, Schneider DF, Leverson GE, et al. Do additional imaging studies change operative management in patients undergoing adrenalectomy? Surgery. 2015;158(4):1003-9; discussion 9-11.	Retrospective study	low level of evidence	The purpose of this study is to determine the incidence of a secondary imaging modality (SIM) in the workup of adrenal masses and the usefulness of this additional imaging in changing surgical management.	Adult patients, age ≥18 years, who underwent at least one imaging study prior to adrenalectomy from February 2001 to August 2014 were identified.	All available pre-operative radiology reports and clinic notes were reviewed for comments regarding the recommendation and/or the completion of additional imaging studies. 292 cases were identified in the database, of which 26 patients with incomplete records and 2 pediatric patients (age < 18) were excluded. There was a slight female predominance and the majority of the operations were performed laparoscopically, with a conversion rate of 1.7%. Over half of the patients had biochemically active tumors. A retrospective analysis of a prospectively collected adrenal surgery database was performed at the University of Wisconsin.	From February 2001 to August 2014, 264 cases met inclusion criteria, of which 98 (37%) were identified to have SIM. Patients with cancer (P = .001), incidentaloma (P = .002), and pheochromocytoma (P < .0001) were more likely to undergo additional imaging. MRI was the most commonly obtained SIM. In addition, 90 of the 98 cases (92%) met indications for adrenalectomy with primary imaging study and biochemical screening alone. Of the remaining 8 cases, in only 4 instances (4%) did SIM modify surgical decision making. The high incidence of unnecessary additional imaging performed in patients undergoing adrenalectomy is counterproductive to efforts toward cost-conscious, high-quality health care. Patients with adrenal tumors would benefit from early surgical referral to allow the surgeon to help guide clinical decision making and to avoid the use of excessive imaging.	Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; readers were not blinded or no comment was made about the blinding of the readers; single reader or no inter-reader reliability was calculated. Per the authors, "Our study is limited by the retrospective nature of chart-review. Thus, the incidence of secondary imaging could actually be much higher than reported. In addition, by only examining adrenalectomy patients, we are overlooking those with adrenal findings who undergo additional imaging and ultimately do not undergo surgery. This not only underrepresents the incidence of SIM, but also underestimates its impact on cost. As with many tertiary referral centers with a large geographic referral base, patients are referred from many different healthcare systems and providers, each with their own medical record system."
Marty M, Gaye D, Perez P, et al. Diagnostic accuracy of computed tomography to identify adenomas among adrenal incidentalomas in an endocrinological population. Eur J Endocrinol. 2018; 178(5):439-446.	Retrospective study	low level of evidence	To determine relevant thresholds for usual CT parameters for the diagnosis of benign tumors using robust reference standard among a large series of 'true' adrenal incidentalomas (AIs) recruited in an endocrinological setting.	253 AIs in 233 consecutive patients explored in a single university hospital: 183 adenomas, 33 pheochromocytomas, 23 adrenocortical carcinomas, 5 other malignant tumors and 9 other benign tumors.	Reference standard was histopathology in 118 AIs, biological diagnosis of pheochromocytoma in 2 AIs and size stability after at least 1 year of follow-up in 133 AIs.Sensitivity, specificity and positive and negative predictive values were estimated for various thresholds of size, unenhanced attenuation (UA), relative and absolute wash-out (RPW, APW) of contrast media. Scans were reviewed independently in a blinded fashion by two expert radiologists to assess inter-observer reproducibility of measurements.	Criteria associated with a 100% positive predictive value for the diagnosis of benign AI were: a combination of size and UA: 30 mm and 20 HU or 40 mm and 15 HU, respectively; RPW >53%; and APW >78%. Non-adenomatous AIs with rapid contrast wash-out were exclusively benign pseudocysts and pheochromocytomas, suggesting that classical thresholds of 60% and 40% for APW and RPW, respectively, can be safely used for patients with normal metanephrine values. Inter-observer reproducibility of all parameters was excellent (intra-class correlation coefficients: (0.96–0.99). The authors conclude that the results suggest safe thresholds for quantitative CT parameters to avoid false diagnoses of benignity.	Results could have been biased as only a subgroup of patients without typical features of adenomas on unenhanced CT examination were subjected to contrast wash-out studies. 184 of 417 patients with AIs were excluded because they did not meet the one inclusion criteria about a follow-up long enough to ensure a better validity of the reference standard.
Meltzer AC, Burrows PK, Kirkali Z, et al. Accuracy of patient reported stone passage for patients with acute renal colic treated in the emergency department. Urology. 2020; 136:70-74.	Retrospective study	low level of evidence	To study patients who initially presented to the Emergency Department with acute renal colic to determine if patient-reported stone passage detects stone expulsion as accurately as follow-up computed tomography (CT) scan.	382 eligible patients for secondary analysis of previous multi-center prospective trial. Of the 382 included, 237 (62.0%) underwent a followup CT scan. For those 237, the mean age was 39.7 years, 26.2% were female, and 27.7% were non-white.	Patient-reported stone passage, defined as capture or visualization of the stone, was compared to CT scan-confirmed passage performed 29-36 days after initial presentation.	The mean (standard deviation) diameter of the symptomatic kidney stone was 3.8 mm (1.4). In those who reported stone passage, 93.8% (91/97) demonstrated passage of the symptomatic ureteral stone on follow-up CT. Of patients who did not report stone passage, 72.1% (101/140) demonstrated passage of their stone on follow-up CT. The authors conclude that, for patients who report capture or visualization of a ureteral stone, a follow-up CT scan may not be needed to verify stone passage. For patients who do not capture their stone or visualize stone passage, imaging should be considered to confirm passage.	The most significant limitation of our study is that the patients who underwent a follow-up CT scan were different from those who did not get a follow-up CT scan in some ways. Several findings suggest that the study may be susceptible to both selection bias and work-up bias. Patients who underwent a follow-up CT scan were less likely to report stone passage when contacted, less likely to have distal stones and less likely to be white than those who did not return for a follow-up CT scan.

Millet I, Sebbane M, Molinari N, et al. Systematic unenhanced CT for acute abdominal symptoms in the elderly patients improves both emergency department diagnosis and prompt clinical management. Eur Radiol. 2017;27(2):868-77.	Prospective Study	moderate level of evidence	To assess the added-value of systematic unenhanced abdominal computed tomography (CT) on emergency department (ED) diagnosis and management accuracy compared to current practice, in elderly patients with non-traumatic acute abdominal symptoms.	This study was conducted in the adult ED of an urban university hospital with an annual census of 70,000 visits from May 2012 to April 2014. It was a single centre prospective study that included consecutive patients, 75 years of age or older, who had been admitted to the ED with acute nontraumatic abdominal symptoms. Exclusion criteria were: post-traumatic abdominal pain, CT abdominal imaging performed in the previous week and severe cognitive impairment resulting in an inability to give informed consent. The study sample included 401 patients (median age: 85 years (IQR=81–90 y), 152 (38 %) males and 249 (62 %) females).	ED diagnosis and intended management before CT, after unenhanced CT, and after contrast CT if requested, were recorded. Diagnosis and management accuracies were evaluated and compared before CT (clinical strategy) and for two conditional strategies (current practice and systematic unenhanced CT). An expert clinical panel assigned a final diagnosis and management after a 3-month follow-up.	Systematic unenhanced CT significantly improved the accurate diagnosis (76.8% to 85%, p=1.1x10-6) and management (88.5% to 95.8%, p=2.6x10-6) rates compared to current practice. It allowed diagnosing 30.3% of acute unsuspected pathologies, 3.4% of which were unexpected surgical procedure requirement. Mechanical bowel obstruction (11.5 %), fecal impaction (12.2 %) and non-specific abdominal pain (10.7 %) are the most frequently specific diagnoses. About two-thirds (65.6 %) of the population needed hospitalization, among which 42.2 % required surgery or invasive procedure. Systematic unenhanced abdominal CT improves ED diagnosis accuracy and appropriate management in elderly patients presenting with acute abdominal symptoms compared to current practice.	Per the authors, the study has some limitations. First, it was conducted in a single centre with a high rate of CT requested in standard management (78%). This rate was superior to that of previous studies, which reported 52–59 % of CT performed in patients > 60 years to assess causes of abdominal pain. This higher rate may have been due to our study population since we included patients > 75 years old, more in line with current benchmark used in studies focused on elderly patients. Our rate may have been artificially increased by study design, which could have encouraged requests for CT examination in order to obtain a specific diagnosis. Secondly, there was a high number of physicians with varying levels of experience answering questionnaires, which could have led to variations in their CT prescription practices. However, we think it reflected daily ED clinical practice and made the investigation more generalizable. Thirdly, the intended treatment prior to CT was not defined by a senior surgeon, which may have led to overestimation of intended admission for surgery before CT. Lastly, we did not investigate US as a potential routine test that could also affect the diagnosis and management accuracy.
Moore CL, Daniels B, Ghita M, et al. Accuracy of reduced-dose computed tomography for ureteral stones in emergency department patients. Ann Emerg Med. 2015;65(2):189-98.e2.	Prospective blinded observational study	high level of evidence	Reduced-dose computed tomography (CT) scans have been recommended for diagnosis of kidney stone but are rarely used in the emergency department (ED) setting. Test characteristics are incompletely characterized, particularly in obese patients. The authors' primary outcome is to determine the sensitivity and specificity of a reduced-dose CT protocol for symptomatic ureteral stones, particularly those large enough to require intervention, using a protocol stratified by patient size.	Subjects were eligible if they were aged 18 years or older and capable of providing written informed consent. Research associates circulated in the ED to seek eligible subjects and were also notified automatically by pager whenever a renal colic CT scan was ordered from the ED. All CT scans conducted during enrollment periods were reviewed retrospectively to identify any patients missed for enrollment. Exclusion criteria were not provided in the study. The final sample included 201 patients with mean age 44 years, with 52% being men. The mean BMI was 29.1 kg/m2 (SD 7.8), and 58.7% received the high-BMI protocol.	Prospective, blinded observational study of 201 patients at an academic medical center. Consenting subjects underwent both regular- and reduced-dose CT, stratified into a high and low body mass index (BMI) protocol based on effective abdominal diameter. Reduced-dose CT scans were interpreted by radiologists blinded to regular-dose interpretations. Follow-up for outcome and intervention was performed at 90 days.	CT scans with both regular and reduced doses were conducted for 201 patients, with 63% receiving the high BMI reduced-dose protocol. Ureteral stone was identified in 102 patients (50.7%) of those receiving regular-dose CT, with a ureteral stone greater than 5 mm identified in 26 subjects (12.9%). Sensitivity of the reduced-dose CT for any ureteral stone was 90.2% (95% confidence interval [CI] 82.3% to 95.0%), with a specificity of 99.0% (95% CI 93.7% to 100.0%). For stones greater than 5 mm, sensitivity was 100% (95% CI 85.0% to 100.0%). Reduced-dose CT identified 96% of patients who required intervention for ureteral stone within 90 days. Mean reduction in size-specific dose estimate was 18.6 milligray (mGy), from 21.7 mGy (SD 9.7) to 3.4 mGy (SD 0.9). CT with substantial dose reduction was 90.2% (95% CI 82.3% to 95.0%) sensitive and 98.9% (95% CI 85.0% to 100.0%) specific for ureteral stones in ED patients with a wide range of BMIs. Reduced-dose CT was 96.0% (95% CI 80.5% to 99.3%) sensitive for ureteral stones requiring intervention within 90 days.	Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; single reader or no inter-reader reliability was calculated. Per the authors, "Our study implemented our protocol on only one type of CT scanner from a single manufacturer in a single center, and these results may not be generalizable to other institutions. It is possible that the accuracy reported here is different from that of radiologists without specialty training who are reading scans as part of routine clinical care."
Muth A, Hammarstedt L, Hellstrom M, et al. Cohort study of patients with adrenal lesions discovered incidentally. Br J Surg. 2011;98(10):1383-91.	Prospective cohort study	moderate level of evidence	This prospective cohort study investigated the incidence, clinical features and natural history of incidentally discovered adrenal mass lesions (adrenal incidentaloma, AI) in an unselected population undergoing radiological examination.	During an 18-month period, all patients with AI were reported prospectively from all 19 radiology departments in western Sweden. Inclusion criteria were: incidentally discovered adrenal enlargement or mass lesion in patients without extra-adrenal malignancy on detection. Patients with symptoms or signs of adrenal disease, with previously known adrenal enlargement or tumour, or who were referred specifically for examination of the adrenal(s) were not included. Of 534 patients assessed for eligibility, 226 (mean age 67 years, 62.4 per cent women; mean lesion diameter 23.9 mm, 22.6 per cent bilateral) fulfilled the inclusion criteria.	Clinical and biochemical evaluation was performed on inclusion and after 24 months. Computed tomography (CT) of the adrenals was scheduled at 4, 12 and 24 months. Magnetic resonance imaging was performed for lesions larger than 20 mm. The indications for surgical excision were: hormone activity, lesion diameter more than 30 mm, lesion growth or other radiological features suspicious of malignancy. Mean follow-up was 19.0 months.	After baseline evaluation, 14 patients had surgery owing to primary hyperaldosteronism (3), catecholamine-producing tumour (1), tumour size (6), size and indication of subclinical hypercortisolism (3) and metastasis (1). No hypersecreting lesions were confirmed during follow-up; one patient underwent adrenalectomy for a suspected phaeochromocytoma (adrenocortical adenoma at histopathology). No primary adrenal malignancy was found. In this prospective cohort study 6.6 per cent of patients with an AI had surgery and benign hormone-producing tumours were verified in 3.1 per cent. Repeat CT and hormone evaluation after 2 years did not increase the sensitivity for diagnosis of malignant or hormone-producing tumours.	Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; single reader or no inter-reader reliability was calculated. Per the authors, "A potential weakness of the present study that deserves consideration is the diagnosis of SH. There are data indicating a relationship between SH and the metabolic syndrome. The present study was not designed to identify patients with SH; a more comprehensive work-up might have revealed additional cases. "
Nogueira TM, Lirov R, Caoili EM, et al. Radiographic Characteristics of Adrenal Masses Preceding the Diagnosis of Adrenocortical Cancer. Horm Cancer. 2015;6(4):176-81.	Retrospective study	moderate level of evidence	Incidentally discovered adrenal masses are common and the clinical evaluation and surveillance aims to diagnose hormone excess and malignancy. Adrenocortical cancer (ACC) is a very rare malignancy. This study aims to define the imaging characteristics of adrenal tumors preceding the diagnosis of ACC.	Patients with prior (> 5 months) adrenal tumors (< 6 cm) subsequently diagnosed with ACC were identified in a large registry at a tertiary referral center. Retrospective chart and image review for patient characteristics and initial, interval, and diagnostic imaging characteristics (size, homogeneity, borders, density, growth rate, etc.) was conducted. Twenty patients with a diagnosis of ACC and a prior adrenal tumor were identified among 422 patients with ACC. Of these, 17 patients were initially imaged with CT and 3 with MR.	Retrospective chart and image review for patient characteristics and initial, interval, and diagnostic imaging characteristics (size, homogeneity, borders, density, growth rate, etc.) was conducted.	Twenty patients with a diagnosis of ACC and a prior adrenal tumor were identified among 422 patients with ACC. Of these, 17 patients were initially imaged with CT and 3 with MR. Only 2 of the 20 patients had initial imaging characteristics suggestive of a benign lesion. Of initial tumors, 25% were <2 cm in size. Surveillance led to the diagnosis of ACC within 24 months in 50% of patients. The growth pattern was variable with some lesions showing long-term stability (up to 8 years) in size. In conclusion, antecedent lesions in patients with a diagnosis of ACC are often indeterminate by imaging criteria and can be small. Surveillance over 2 years detected only 50% of ACCs. Current practice and guidelines are insufficient in diagnosing ACCs. Given the rarity of ACC, the increased risk and health care costs of additional evaluation may not be warranted.	Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; readers were not blinded or no comment was made about the blinding of the readers; single reader or no inter-reader reliability was calculated. Per the authors, " A limitation of this study is the retrospective nature including the often incomplete work-up of adrenal nodules not in accordance with suggested guidelines and lack of proof for a pathogenic connection between initial lesions and the later diagnosed malignant tumor. Another concern is the non-standardized follow-up of the patients in this study, exclusively at institutions other than our own center. Imaging cannot determine whether the initial lesions represent adenomatous precursors or small ACCs."

Odenrick A, Kartalis N, Voulgarakis N, et al. The role of contrast-enhanced computed tomography to detect renal stones. Abdom Radiol. 2019; 44(2):652-660.	Retrospective study	low level of evidence	To investigate the detectability of renal stones in corticomedullary and nephrographic phases on contrast-enhanced computed tomography (CT).	All consecutive patients between January 2012 and February 2016 that underwent MDCT of the kidneys according to our department's four-phase standard protocol and with at least one renal stone confirmed in the NCP were included in the study. We included mainly patients undergoing investigation of macroscopic hematuria or patients with treated renal malignancy undergoing follow-up investigation. No ureteral stones were included in the study. We excluded patients: (1) where the calcification was located in the walls of a vessel or a cyst, (2) where due to technical reasons, the contrast enhancement of the renal cortex was poor, (3) where the dose of IV contrast media was lower than the standard dose [< 0.5 g iodine (I) per Kg body-weight] due to renal dysfunction, (4) where medullary nephrocalcinosis was suspected, and (5) where the stones were located in the ureter.	Two radiologists in consensus evaluated the NCP from each examination and documented the number, location, and size of stones. Three abdominal radiologists blinded to the findings of the NCP reviewed independently the corticomedullary and nephrographic phases on two different occasions. They reported the number and location of stones in each kidney. For the inter-observer agreement the intra-class correlation coefficient (ICC) was estimated. The detection rate of renal stones was calculated for the three radiologists and compared between the two contrastenhanced phases and the results were analyzed with concern to the size of the stones.	The ICC was 0.86. There was no statistically significant difference between corticomedullary and nephrographic phases (p = 0.94). The detection rate for stones measuring 3–5 mm was 82–88% and 98% for stones ≥6 mm. The authors conclude that he detectability of renal stones ≥ 6 mm on contrast-enhanced CT is extremely high. This means that stones with a higher risk of not passing spontaneously can be safely diagnosed.	This retrospective study has several limitations. A potential limitation was the absence of cases without stone disease; however, we aimed to evaluate the detectability of renal stones and not the diagnostic accuracy of contrast-enhanced CT. The reviewers were aware of this so there is a risk for bias to overcall in our study. Two of the three readers performed similarly regarding false negatives and false positives results. The third reader, however, had much higher rates of false positives results compared to the other two. Another limitation that might influence our results is that the patient group was not homogenous since the examinations were performed for different indications.
Pandharipande PV, Alabre CI, Coy DL, et al. Changes in Physician Decision Making after CT: A Prospective Multicenter Study in Primary Care Settings. Radiology. 2016;281(3):835-46.	Prospective study	moderate level of evidence	To determine the effect of computed tomography (CT) results on physician decision making in three common clinical scenarios in primary care.	Patients were eligible for inclusion if they were adults (age ≥ 18 years) who were referred for outpatient CT to evaluate a study indication. For symptoms of abdominal pain and hematuria, patients with abdominal CT requests were eligible. For weight loss, patients with chest or abdominal CT requests were eligible. Patients could be enrolled in the study only once. Mean age was 59.6 + - 15.6 years.	Prior to CT, PCPs were surveyed to elicit their leading diagnosis, confidence in that diagnosis (confidence range, 0%-100%), a rule-out diagnosis, and a management plan if CT were not available. Surveys were repeated after CT. Study measures were the proportion of patients in whom leading diagnoses and management changed (PCP management vs specialist referral vs emergency department transfer), median changes in diagnostic confidence, and the proportion of patients in whom CT addressed rule-out diagnoses. Regression analyses were used to identify associations between study measures and site and participant characteristics. Specifically, logistic regression analysis was used for binary study measures (change in leading diagnosis, change in management), and linear regression analysis was used for the continuous study measure (change in diagnostic confidence). Accrual began on September 5, 2012, and ended on June 28, 2014. Results	In total, 91 PCPs completed pre- and post-CT surveys in 373 patients. In patients with abdominal pain, hematuria, or weight loss, leading diagnoses changed after CT in 53% (131 of 246), 49% (36 of 73), and 57% (27 of 47) of patients, respectively. Management changed in 35% (86 of 248), 27% (20 of 74), and 54% (26 of 48) of patients, respectively. Median absolute changes in diagnostic confidence were substantial and significant (+20%, +20%, and +19%, respectively; P <= .001 for all); median confidence after CT was high (90%, 88%, and 80%, respectively). PCPs reported CT was helpful in confirming or excluding rule-out diagnoses in 98% (184 of 187), 97% (59 of 61), and 97% (33 of 34) of patients, respectively. Significant associations between primary measures and site and participant characteristics were not identified. Changes in PCP leading diagnoses and management after CT were common, and diagnostic confidence increased substantially.	Readers were not blinded or no comment was made about the blinding of the readers; single reader or no inter-reader reliability was calculated. "Sources of bias-small sample size (the study is not powered to make statistically significant conclusions),selection bias (They were able to approach only a subset (n = 331) of practicing PCPs across the participating institutions. Among these PCPs, our consent rate was low (35% [115 of 331]) and all PCPs did not complete the same number of surveys. The study design did not permit definitive attribution of changes in decision making to CT results. "
Patrova J, Jarocka I, Wahrenberg H, et al. Clinical Outcomes in Adrenal Incidentaloma: Experience from One Center. Endocr Pract. 2015;21(8):870-7.	Retrospective study	low level of evidence	To investigate the outcome in patients with adrenal incidentaloma (AI).	637 Swedish patients with a diagnosis of adrenal incidentaloma were included. The mean age of the 637 patients (403 females) diagnosed with an AI was 62.7 ± 11.6 years (range, 21 to 89 years). Exclusions were cases where tumors had been found during work-up for a suspected adrenal tumor or during the staging and follow-up of a known malignancy.	A retrospective evaluation of 637 patients with AI referred to a tertiary center over 8 years. Radiologic and hormonal evaluations were performed at baseline. Follow-up imaging was carried out if necessary, and hormonal evaluation was performed at 24 months according to national guidelines.	Hormonal evaluation revealed that 85.4% of all tumors were nonfunctioning adenomas, 4.1% subclinical Cushing syndrome (SCS), 1.4% pheochromocytoma, 1.4% primary hyperaldosteronism, 0.8% Cushing syndrome, 0.6% adrenocortical carcinoma, 0.3% congenital adrenal hyperplasia, 2.2% metastasis to adrenals, and 3.8% other lesions of benign origin. Bilateral tumors were found in 11%, and compared to unilateral tumors, SCS was more prevalent. Only 2 cases were reclassified during follow-up, both as performed at initial work-up. In patients diagnosed with an adrenal metastasis, 92.9% were deceased within 2 years. Excluding those with malignant tumors, 12.9% of patients died during the study period of up to 11 years due to other causes than adrenal. Most AIs were benign, but a small fraction of tumors were functional and malignant. The prognosis of patients with adrenal metastasis was extremely poor, but otherwise, the mortality rate was similar to that for the general population. Follow-up of AIs < 4 cm with an initial nonfunctional profile and benign radiologic appearance appears unwarranted, but screening for congenital adrenal hyperplasia should be considered.	Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; non-consecutive recruitment; readers were not blinded or no comment was made about the blinding of the readers; single reader or no inter-reader reliability was calculated.
Rapp DE, Wood NL, Bassignani M, et al. Clinical variables and stone detection in patients with flank pain. Can J Urol. 2016;23(5):8441-5.	Retrospective cohort study	low level of evidence	Non-contrast CT (NCT) is commonly used to evaluate flank pain (FP). The authors sought to evaluate incidence of ureteral calculi on NCT in patients with FP, and to determine if clinical variables are associated with higher detection rates.	Retrospective review identified 613 patients undergoing NCT for FP. Study inclusion criteria consisted of a presenting complaint of flank pain. Upon inclusion, comprehensive review was performed to identify additional patient demographics, presenting symptoms, lab assessment, NCT findings, and intervention performed. Exclusion criteria were not provided. 613 patients presenting with a chief complaint of flank pain were included in the study analysis. The mean patient age was 49 years +/- 0.6 years.	Patient clinical data, NCT findings, and intervention were analyzed. Focus was placed on variables commonly associated with urolithiasis (Vstone), comprising hematuria, nausea/ vomiting, and prior stone history. Statistical analysis was performed to identify risk of ureteral stones based on number and type of Vstone.	No stone disease was identified on NCT in 175 patients (28.5%). NCT demonstrated 214 (35%), 72 (12%), and 152 (25%) patients with stones located in the kidney, ureter, or both, respectively. Only 33 (5%) patients had FP as their sole Vstone, with ureteral calculi identified in 6% of this cohort. The rate of ureteral calculi increased with more Vstone. Patients having all four Vstone were found to have the highest rate of ureteral stones (59%). Statistical analysis demonstrated a statistically significantly increased relative risk of stone formation given three or four Vstone when compared with FP alone. Whereas isolated FP is associated with a lower rate of ureteral calculus detection, a significant increased relative risk of ureteral calculus is seen in patients with additional clinical variables associated with stone disease. Accordingly, it may be possible to improve detection rates of ureteral stones through the use of additional clinical variables to guide NCT selection.	Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; readers were not blinded or no comment was made about the blinding of the readers; single reader or no inter-reader reliability was calculated. Per the authors, "small sample size may have lead to less power to detect true differences between the two groups. Information bias might be present because they did not have access to all of the information needed from the chart. Selection bias is possible because of the study's retrospective nature."

Smith-Bindman R, Aubin C, Bailitz J, et al. Ultrasonography versus computed tomography for suspected nephrolithiasis. N Engl J Med. 2014. 371(12):1100-10.	Comparative effectiveness trial	high level of evidence	To compare computed tomography (CT) or ultrasonography as the initial imaging method for patients with suspected nephrolithiasis.	Patients 18 to 76 years of age who reported flank or abdominal pain were eligible for entry into the study if the treating emergency physician decided to order imaging to establish or rule out a primary diagnosis of kidney stones. Patients whom the treating physician considered to be at high risk for serious alternative diagnoses, such as acute cholecystitis, appendicitis, aortic aneurysm, or bowel disorders, were not eligible, nor were pregnant women. Men weighing more than 129 kg (285 lb) and women weighing more than 113 kg (250 lb) were excluded, since the accuracy of imaging may be reduced in obese patients. Patients who had a single kidney, who had undergone renal transplantation, or who were undergoing dialysis were ineligible. The mean age was 40 years (range 18-76 years), Overall, 41.6% of the patients had history of kidney stones, 63.3% had hematuria, and 52.5% had costovertebral-angle tenderness.	Study randomly assigned 908 patients to point-of-care ultrasonography, 893 to radiology ultrasonography, and 958 to CT. Subsequent management, including additional imaging, was at the discretion of the physician. Authors compared the three groups with respect to the 30-day incidence of high-risk diagnoses with complications that could be related to missed or delayed diagnosis and the 6-month cumulative radiation exposure. Secondary outcomes were serious adverse events, related serious adverse events (deemed attributable to study participation), pain (assessed on an 11-point visual-analogue scale, with higher scores indicating more severe pain), return emergency department visits, hospitalizations, and diagnostic accuracy.	Proportion of patients with a confirmed stone diagnosis within 6 months after randomization was similar in the three study groups (34.5% in the point-of-care US group, 31.2% in the radiology US group, and 32.7% in the CT group; P = 0.39). The sensitivity and specificity for the diagnosis of nephrolithiasis were similar in the three study groups in the intention-to-treat analysis. Patients in the US groups were more likely than those in the CT group to undergo additional diagnostic testing during the initial ED visit; 40.7% of the patients in the point-of-care US group and 27.0% of the patients in the radiology US group underwent CT, whereas 5.1% of the patients in the CT group underwent US (P<0.001). Patients in the US groups were less likely to undergo additional diagnostic testing with CT when they reported a history of nephrolithiasis (31% vs. 36%, P<0.001). An analysis of diagnostic accuracy for nephrolithiasis showed that US had lower sensitivity and higher specificity than CT: the sensitivity was 54% (95% confidence interval [CI], 48 to 60) for point-of-care US, 57% (95% CI, 51 to 64) for radiology US, and 88% (95% CI, 84 to 92) for CT (P<0.001), and the specificity was 71% (95% CI, 67 to 75), 73% (95% CI, 69 to 77), and 58% (95% CI, 55 to 62), respectively (P<0.001). The mean 6-month cumulative radiation exposure was significantly lower in the US groups than in the CT group (P<0.001). Serious adverse events occurred in 12.4% of the patients assigned to point-of-care US, 10.8% of those assigned to radiology US, and 11.2% of those assigned to CT (P = 0.50).	Readers were not blinded or no comment was made about the blinding of the readers
Song JH, Grand DJ, Beland MD, et al. Morphologic features of 211 adrenal masses at initial contrast-enhanced CT: can we differentiate benign from malignant lesions using imaging features alone? AJR Am J Roentgenol. 2013;201(6):1248-53.	Retrospective study	low level of evidence	The objective of this study was to determine whether morphologic features of adrenal masses detected at initial contrast-enhanced MDCT can differentiate benign from malignant disease.	Patients with adrenal masses between 1 and 4 cm with a final diagnosis established by histology, imaging, or imaging follow-up. Adrenal masses larger than 4 cm were excluded because isolated adrenal masses are usually surgically removed. There were 109 women and 79 men with a mean age of 64 years (range, 23–95 years). Of these 188 patients, 105 (56%) had a history of malignancy.	Three authors blinded to the diagnoses independently reviewed the contrast-enhanced MDCT images of the adrenal masses and evaluated their morphologic features: lesion margin (smooth, lobulated, or irregular), density (homogeneous or heterogeneous), and additional features of central low density and enhancing rim. Using these criteria, the readers categorized each mass as probably benign, indeterminate, or suspicious	There were 171 (81%) benign and 40 (19%) malignant adrenal masses. For individual morphologic features in diagnosing malignancy, irregular margins had 30–33% sensitivity and 95–96% specificity and an enhancing rim had 5–13% sensitivity and 98–99% specificity. None of the imaging features was reliable in predicting benignity. When an adrenal mass was deemed suspicious by a reader, the sensitivities for malignancy ranged from 54% to 74% and specificities from 96% to 97%. No malignant lesions occurred in patients without a known history of cancer. Excluding the indeterminate lesions, the accuracies for the correct diagnosis by the three readers were 89–93%. Among the 40 malignant masses, the mean size of 11 masses deemed suspicious by all readers was larger (mean, 3.1 cm; range, 2.2–4.0 cm) than the mean size of the four masses categorized to be probably benign by all readers (mean, 1.8 cm; range, 1.0–2.9 cm) (p = 0.011). In conclusion, when an adrenal mass has malignant morphologic features, such as an irregular margin and heterogeneous density with a thick enhancing rim, at presenting contrast-enhanced MDCT, it likely represents a malignant lesion. The remaining morphologic features, including a smooth margin and homogeneous density, can be seen in both benign and malignant disease, and are not sufficient for characterization of adrenal masses particularly in patients with a known history of malignancy.	Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; non-consecutive recruitment; readers were not blinded or no comment was made about the blinding of the readers; Per the authors, "The study is retrospective and we had a relatively small number of malignant adrenal lesions (40 lesions, 19% of the study cohort), which is likely because of the high prevalence of benign adrenal masses. A second limitation was that the malignant lesions in our study were limited to metastases, not primary malignant adrenal tumors."
Takanami K, Kaneta T, Morimoto R, et al. Characterization of lipid-rich adrenal tumors by FDG PET/CT: Are they hormone-secreting or not? Ann Nucl Med. 2014;28(2):145-53.	Retrospective study	low level of evidence	The purpose of this study was to evaluate the diagnostic ability of FDG PET/CT to predict the hormone-secretion status of lipid-rich adrenal tumors.	Initially, 146 patients who underwent FDG PET/CT for assessment of 162 adrenal tumors, regardless of tumor size and detected by CT between 10/2008 – 12/2012 were identified. The inclusion criteria for patients who completed the analysis were as follows: lipid-rich adrenal tumor 2 cm or larger in diameter, tumor was surgically resected and histologically diagnosed or was followed by CT for at least 6 months. No explicit exclusion criteria were documented for this study. A total of 29 lipid-rich adrenal tumors in 28 patients satisfied the inclusion criteria as above and were included in the analysis. These consisted of 16 non-hormone-secreting tumors and 13 hormone-secreting tumors (no patients had malignant/metastatic tumors or pheochromocytomas). Demographics for patients w/ non-hormone secreting tumors (n = 15) and those w/ hormone-secreting tumors (n = 13) were as follows: median (range) age of 57 (34-79) and 49 (36-64) years, female:male gender ratio of 7:8 and 11:2, and BMI of 23.7 (19.0-29.7) and 22.8 (20.4-37.7). The female:male gender ratio was significantly different between these two groups (p < 0.05).	Ultimate hormone-secretion status of adrenal tumors was determined by endocrine examinations (e.g. ACTH, cortisol, catecholamine levels, dexamethasone suppression test), adrenal venous sampling, surgical resection and histopathology, or morphological imaging follow-up during a period of at least 6 months. FDG PET/CT images were evaluated by a nuclear medicine physician who was aware of the presence of adrenal tumors and the preceding CT findings, though was unaware of the surgical and pathological findings.	The SUVmax of the adrenal tumor ROI and VOI of the right hepatic lobe were used for statistical comparisons. The SUVmax (median, range) of the hormone-secreting tumors (3.2, 2.0–8.3) was higher than that of the non-hormone-secreting tumors (2.4, 1.8–3.3) (p < 0.05). Similarly, the SUVratio (SUVmax adrenal/SUVmax liver) of the hormone-secreting tumors (0.95, 0.70–3.10) was higher than that of the non-hormone-secreting tumors (0.72, 0.54–0.95) (p < 0.01). No significant differences were observed in the tumor diameter (p = 0.74), CT value (p = 0.25) or SUVmax of the liver (p = 0.93) between the two groups. The SUVratio was used to calculate the diagnostic accuracy to differentiate the hormone-secreting tumors from the non-hormone-secreting ones, because the AUC based on the SUVratio (0.80) was higher than that based on the SUVmax (0.75). As a result, the sensitivity, specificity, PPV, NPV and accuracy of FDG PET/CT for the differentiation of the hormone-secreting and non-secreting tumors were 0.69, 0.81, 0.75, 0.77 and 0.76 for the cutoff SUVratio of 0.80, and were 0.46, 1, 1, 0.70 and 0.76 for the cutoff SUVratio of 1, respectively. A lipid-rich adrenal tumor presenting increased FDG uptake compared with that of the liver is likely to be a hormone-secreting adenoma. Therefore, additional endocrinological investigations are strongly recommended when an FDG-avid lipid-rich incidentaloma is detected on FDG PET/CT.	Readers were not blinded or no comment was made about the blinding of the readers; single reader or no inter-reader reliability was calculated. Per the authors: "First, a selection bias may exist due to the retrospective study design and small number of participants. Second, adrenal tumors measuring 1-2 cm in size, which are the most frequently observed in patients with adrenal incidentalomas, were not included in this study. Third, this study did not investigate whether the SUVmax of benign lipid-poor adenomas is associated with the hormone secretion status."

Tan WS, Sarpong R, Khetrapal P, et al. Can renal and bladder ultrasound replace computerized tomography urogram in patients investigated for microscopic hematuria? J Urol. 2018; 200(5):973-980.	Prospective observational study	moderate level of evidence	To determine the incidence of urinary tract cancer and compare the diagnostic accuracy of CTU and renal and bladder ultrasound (RBUS) at identifying urinary tract cancer.	3,556 patients with a median age of 68 years (range: 57-76) were recruited. The overall incidence of urinary tract cancer was 10.0% (bladder cancer 8.1%, renal cancer 1.0%, UTUC 0.5%).	2166 patients had RBUS and 1692 had CTU; all patients additionally had cystoscopy. A medical history and physical examination were performed on all patients. Renal cancer and UTUC were confirmed by histopathological examination where nephrectomy or renal biopsy were performed with the exception of a small number of renal cancers which had active surveillance without biopsy. Renal calculi diagnosed on CTU was used as the reference standard.	The incidence of bladder, renal and upper tract urothelial cancer (UTUC) were 11.0%, 1.4% and 0.8% respectively in macroscopic hematuria patients. Patients with microscopic hematuria had a 2.7%, 0.4% and 0% incidence of bladder, renal and UTUC respectively. The sensitivity and negative predictive value (NPV) of RBUS for the detection of renal cancer was 85.7% and 99.9% respectively but 14.3% and 99.7% for the detection of UTUC. RBUS was poor at identifying renal calculi. Sensitivity of RBUS was lower than CTU for the detection of bladder cancer (both <85%). Cystoscopy has a specificity and 59 PPV of 98.3% and 83.9% respectively. The authors conclude that CTU can be safely replaced with RBUS in patients with microscopic hematuria. The incidence of UTUC is 0.8% in patients with macroscopic hematuria and CTU is recommended. Patients with supected renal calculi will require non-contrast renal tract CT. Imaging cannot replace cystoscopy to diagnose bladder cancer.	There are several limitations to this study. While we did not identify any UTUC presenting with microscopic hematuria, it is plausible that these patients might have initially presented with microscopic hematuria if screening for microscopic hematuria was performed although this is not recommended by any consensus. While sonographers normally will visualise the renal tract with the bladder distended to adequately visualise the bladder, this was not performed in all cases. Similarly, assessment of the urinary bladder was limited in some CTU scans where contrast did not opacify the bladder or where the was artefact due to metal work in the pelvis. To account for these suboptimal scans, we exclude these scans to determine the diagnostic accuracy of imaging to identify bladder cancer. Additionally, we cannot determine the sensitivity of cystoscopy as we are unable to determine if tumors were missed due as patients with a normal cystoscopy were discharged and did not have a repeat test.
Weinrich JM, Bannas P, Regier M, et al. Low-dose CT for evaluation of suspected urolithiasis: Diagnostic yield for assessment of alternative diagnoses. AJR Am J Roentgenol. 2018; 210(3):557-563.	Retrospective study	low level of evidence	To assess the diagnostic yield of low-dose (LD) CT for alternative diagnoses in patients with suspected urolithiasis.	776 consecutive patients (537 men and 239 women; mean [± SD] age, 48.7 ± 16.9 years; age range, 16–93 years) who underwent unenhanced abdominal CT for evaluation of suspected urolithiasis.	All examinations were performed with an LD CT protocol; images were reconstructed using iterative reconstruction. The leading LD CT diagnosis was recorded for each patient and compared with the final clinical diagnosis, which served as the reference standard.	The mean (± SD) effective dose of CT was 1.9 ± 0.6 mSv. The frequency of urolithiasis was 82.5% (640/776). LD CT reached a sensitivity of 94.1% (602/640), a specificity of 100.0% (136/136), and an accuracy of 95.1% (738/776) for the detection of urolithiasis. In 93 of 136 patients (68.4%) without urolithiasis, alternative diagnoses were established as the final clinical diagnoses. Alternative diagnoses were most commonly located in the genitourinary (n = 53) and gastrointestinal (n = 18) tracts. LD CT correctly provided alternative diagnoses for 57 patients (61.3%) and was false-negative for five patients (5.4%). The most common clinical alternative diagnoses were urinary tract infections (n = 22). Seven diagnoses missed at LD CT were located outside the FOV. For 43 of all 776 patients (5.5%), neither LD CT nor clinical workup could establish a final diagnosis. The sensitivity, specificity, and accuracy of LD CT for the detection of alternative diagnoses were 91.9% (57/62), 95.6% (43/45), and 93.5% (100/107), respectively. The authors conclude that.LD CT enables the diagnosis of most alternative diagnoses in the setting of suspected urolithiasis. The most frequent alternative diagnoses missed by LD CT are urinary tract infections or diagnoses located outside the FOV of the abdominopelvic CT scan.	Several limitations have to be taken into account. First, because of the retrospective nature of the study, we were not able to directly assess the effect of LD CT with iterative reconstruction on patient triage. However, it is likely that results from LD CT with iterative reconstruction directly affected patient triage for most patients because of the high diagnostic accuracy of CT for both urolithiasis and alternative diagnoses. Second, our reference standard relies on follow-up data because, for most patients, no pathologic or surgical intervention was performed. However, we believe that this is the best possibility to create a reference standard in such retrospective studies. Third, the low number of 31 patients with both alternative diagnoses and known BMI precluded a reliable statistical analysis regarding the influence of BMI on diagnostic accuracy of alternative diagnoses. Future prospective studies will be needed to address whether the diagnostic accuracy for alternative diagnosis varies depending on BMI in LD CT. Last, even though frequencies of urolithiasis are within the range of previous studies, patient triage and the threshold for CT might have affected our results.
Young KM, Wong MK, Mitsunaga MM, et al. Evaluation of Small Adrenal Incidental Nodules: Is Imaging Follow-Up Necessary? Perm. 2016;20(1):13-8.	Retrospective study	low level evidence	To determine whether follow-up imaging for small (<= 4 cm) incidental adrenal nodules is necessary for patients without known cancer.	Patients with a known primary cancer were excluded from the analysis unless they had a prior CT scan that documented an incidental adrenal nodule. A total of 392 patients with an incidental adrenal nodule had a mean (standard deviation [SD]) clinical follow-up of 6.7 (2.7) years. There were 200 men and 192 women with a mean (SD) age of 66.0 (13.2) years.	The authors performed a retrospective analysis of all patients found to have an incidental adrenal nodule on abdominal computed tomography (CT) scan during a 27-month period. The electronic medical record was reviewed to determine clinical outcomes in all patients with a minimum of 3 years of follow-up (mean follow-up = 6.7 years). Unenhanced CT attenuation was measured for all nodules, if available.	None of the patients developed primary adrenocortical carcinoma during the follow-up period.Two hundred forty of these patients also had a minimum 3 years of imaging follow-up (mean [SD], 6.4 [2.4] years; range, 3.1-13.6 years). There were 173 left-sided and 91 right-sided nodules on index CT scan. There was no significant difference in the mean (SD) rate of growth between left- and right-sided nodules (0.1 [0.8] mm/year vs 0.1 [0.8] mm/year, p = 0.58). Mean unenhanced CT attenuation of adrenal nodules did not affect the likelihood of adrenal malignancy during follow-up. Patients with small incidental adrenal nodules do not require additional imaging to exclude the possibility of adrenocortical carcinoma.	retrospective study design with large loss of the follow-up and inconsistent follow-up practices with few primary events (only 1 adreno cortical carcinoma)