

## CASE 2

### 33 YEAR OLD MALE WITH ABDOMINAL PAIN

#### —Initial Visit\*—

**CHIEF COMPLAINT (at 20:50):** Abdominal pain

VITAL SIGNS						
Time	Temp	Pulse	Resp	Syst	Diast	Pain
21:16	98.0	72	18	128	60	10
23:33		76	16	104	64	2

**HISTORY OF PRESENT ILLNESS (at 21:06):** He is a 33 year old male who states that at 7pm, after having normal BM, he developed gradual onset of RLQ and lower abdominal pain. He describes it as a bloating, spasm pain. After BM, pt noted urinary stream cut off and was no longer able to urinate. Gradually pain got worse, intermittent RLQ pain radiated into the right groin and testicles. Pain is 8/10 with spasms, mild nausea with pain. No dysuria, hematuria, testicular swelling, flank pain, chest pain, or fever/chills. Pt has no history of kidney stones but grandfather had many kidney stones.

#### PAST MEDICAL HISTORY/TRIAGE:

**Medications:** Claritin D

**Allergies:** No known allergies.

**PMH:** None

**PSH:** None

#### EXAM (at 21:15):

**General:** Well-appearing; well-nourished; A&O X 3, in no apparent distress

**Head:** Normocephalic; atraumatic.

**Eyes:** PERRL

**Nose:** The nose is normal in appearance without rhinorrhea

**Resp:** Normal chest excursion with respiration; breath sounds clear and equal bilaterally; no wheezes, rhonchi, or rales

**Card:** Regular rhythm, without murmurs, rub or gallop

**Abd:** Non-distended; Tender RLQ but no rebound. Mild right flank/side pain. No rigidity, rebound or guarding

**Skin:** Normal for age and race; warm and dry; no apparent lesions

**GU Exam:** External genitalia normal, no urethral discharge, testes descended bilaterally. No lesions noted on penis or scrotum. Epididymus normal bilaterally.

**Authors' Note:** the ED Visits are the attending ED doctor(s)' actual complete notes, including any of abbreviations (and misspellings) they may have used

**ORDERS (at 21:25):** Dilaudid 1 mg IVP, Toradol 30 mg IVP, Phenergan 12.5 mg IVP, .9NS-500cc bolus then 125cc/hr.

**RESULTS (at 22:09):**

**Urine dip:** WNL except: Bilirubin - 1 mg/dL

**Noncontrast helical CT of the abdomen/pelvis (at 22:29)** - Unremarkable helical CT of the abdomen and pelvis.

**PROGRESS NOTE (at 23:23):** Pt felt much better but still had pain into the lower abd. bilaterally with sitting up.

**DIAGNOSIS** - Abdominal pain, unspecified site, Suspect bladder spasms.

**DISPOSITION (at 23:41)** - The patient was discharged to Home ambulatory. Follow-up with primary care physician in 2 days. Prescription for Vicodin 5mg. Aftercare instructions for abdominal pain and kidney stone/renal colic.

**Gregory L. Henry comments:**

**"The male genitalia as a source of discomfort is quickly excluded on physical examination—we are then left with a limited number of abdominal structures as a source of right lower quadrant pain."**

Any human with pain below the umbilicus can have appendicitis. CT scanning, while not as accurate as originally thought, is appropriate.

The history describes bloating and spasm, not uncommon complaints in adults with appendicitis. The complaint of urinary difficulty is essentially a smoke screen; the bottom line is that we have a 33-year-old male with right lower quadrant pain. In a male, the structures located in the right lower quadrant are few and far between—males are not females. The male genitalia as a source of discomfort is quickly excluded on physical examination—we are then left with a limited number of abdominal structures as a source of right lower quadrant pain.

The evaluation of this patient was typical and the abdominal examination seems to be in order. The right lower quadrant tenderness, without rebound or guarding, was noted, although these findings are always dependent upon the examiner's skill. No comment was made of obturator sign, which may be helpful in a case that is equivocal. The external genitalia were properly examined, and no evidence of hernia or genital abnormality could be found. This, along with clean urine, makes a genitourinary infection unlikely.

I agree that medication for pain relief is appropriate; there is no evidence that a diagnosis is influenced one way or the other after the use of analgesics. With a family history of kidney stones,

a helical CT was appropriately performed, which ruled out kidney stone or aortic aneurysm as the problem. The patient was then discharged home to follow up with the primary doctor in 2 days. The biggest problem in this case is not the evaluation, but the discharge program. A patient with a negative workup, and persistent right lower quadrant pain needs to be told that appendicitis is still a reasonable possibility; timeframe for follow-up should be 6 to 8 hours. If the patient is not completely pain free by this time, have the patient return to the ED for re-evaluation, or set up a re-evaluation with the patient's private physician. Most abdominal processes declare themselves within 12 hours.

The initial workup was not overly aggressive from a laboratory standpoint and this is a good thing. No specific blood test would answer any questions about this patient. Slight elevations in the white blood count can be seen with virtually any process and do not help decision making. The risk management problem here is not the history, physical, or laboratory studies—it is the discharge program.

- **Thoroughness of Documentation:** 8 out of 10.
- **Thoroughness of Patient Evaluation:** 8 out of 10.
- **Risk of Serious Illness Being Missed:** High risk.
- **Risk Management Legal Rating:** High risk secondary to the inadequate discharge program.

## 33 YEAR OLD MALE WITH ABDOMINAL PAIN

—Second Visit: Less than 24 Hours Later—

**CHIEF COMPLAINT (at 17:18):** Abdominal pain

VITALS SIGNS						
Time	Temp	Pulse	Resp	Syst	Diast	Pain
17:29	98.3	115	24	144	92	10
18:54		120	16	100	50	9
20:30		112	16	140	80	5

**HISTORY OF PRESENT ILLNESS (at 18:17):** The patient is a 33-year-old male who developed right-sided abdominal pain yesterday. He states he was fine yesterday during the day and went to work. When he came home, he had a bowel movement. He subsequently described the pain in his right lower quadrant, which he states felt like a gaseous pain and then it developed to a sharp-burning pain that was intermittently sharp. The patient had some slight nausea at that time and had 1 episode of emesis. He presented to this ER last evening. The patient had a urinalysis which was reportedly unremarkable, received IV pain medication, and helical CT scan to rule out kidney stone and told this was unremarkable. The patient was sent home. He states that he woke up at 4 o'clock this morning with continued pain in the right lower quadrant of his abdomen. He denies any

radiation of the pain. He continues to feel nauseous and threw up once today. He has had nothing to eat today. About 2 p.m., the patient began feeling febrile. The patient denies any radiation of the pain into his testicles or into his flank. Denies chest pain, shortness of breath, calf muscle pain, leg/foot edema, diarrhea, bloody stools, dysuria, urinary frequency, hematuria, no urinary incontinence, rhinorrhea, cough, no loss of consciousness, or paresthesias.

**PAST MEDICAL HISTORY/TRIAGE:**

**Medications:** Claritin D

**Allergies:** No known allergies.

**PMH:** None

**PSH:** None

**PHYSICAL EXAMINATION (at 18:25):**

**General:** A white male who appears quite ill.

**Vital:** Afebrile. Vital signs are stable as documented on the chart.

**Lungs:** Clear to auscultation without wheeze.

**Cardiovascular:** Regular rate and rhythm.

**Back:** There is no CVA tenderness.

**Abdomen:** Positive bowel sounds, soft, and tender to palpation in the right lower quadrant with referred pain in the left lower quadrant and over to the right lower quadrant. There is mild guarding. No rebound.

**Genitourinary:** Testicular examination shows no masses. Epididymis is nonenlarged, and there is no hernia palpable.

**ORDERS (at 18:28):**

Demerol 50 mg IVP, Phenergan 12.5 mg IVP, Cefotan 1 g IVPB

IV: .9NS-500cc bolus then to 125cc/hour

**RESULTS (at 19:04):**

Test	Flag	Value	Units	Ref. range
WBC	H	16.0	K/uL	4.6-10.2
HGB		14.5	G/DL	13.5-17.5
PLT		235	K/uL	142-424
NA		136	MMOL/L	135-144
K		3.7	MMOL/L	3.5-5.1
CL		94	MMOL/L	98-107
AGAP		12.4	MMOL/L	6.0-18.0
CO2		28	MMOL/L	22-29
GLU		129		70-119
BUN		11	MG/DL	7-18
CREAT		1.1	MG/DL	0.6-1.3
<b>Urinalysis - WNL</b>				

**DIAGNOSIS (at 20:17):**

Acute appendicitis without mention of peritonitis

**DISPOSITION (at 20:21):**

Admitted to surgical service

**HOSPITAL COURSE:**

**\*\*\*\*\* Operative Report \*\*\*\*\***

**Preoperative diagnosis:** Appendicitis.

**Postoperative diagnosis:** Locally ruptured appendix.

**Procedure:** On opening the peritoneum, we immediately get return of yellow purulent fluid, which we aspirated up and then also cultured. We immediately encounter the appendix, which is lateral retrocecal in location. Grossly, it is obvious that there is appendicitis. In fact, there are a couple of areas of necrosis and one small pinpoint perforation near the mid-to-distal portion of the appendix from which there is a small amount of purulent fluid draining.

**Surgeon progress note:**

The patient was admitted to the hospital with right lower quadrant pain. He was felt to have ruptured appendicitis. He underwent an appendectomy, and at the time of surgery, he was found to have a ruptured appendix. He was treated with intravenous fluids and antibiotics. Postoperatively, he became quite distended and had developed a postoperative ileus. This required placement of an NG tube. The NG tube helped decompress the intestinal tract slowly over the time. Eventually, we were able to wean him off the intravenous pain medicine and gradually advanced his diet when his intestinal tract returned to some degree of function. Ultimately, he was able to be advanced on a diet to the point of tolerating food and no longer developing any distention. He then had some return of intestinal function that was adequate to allow him to be discharged 5 days after admission.

**\*\*\*\*\* Discharge Summary Report \*\*\*\*\***

**FINAL DIAGNOSIS:** Ruptured appendicitis and postoperative ileus.



## DIAGNOSIS AND MANAGEMENT OF ABDOMINAL PAIN

Scott W. Melanson, MD, FACEP

### I. INTRODUCTION

Every day emergency physicians are faced with decisions concerning patients with abdominal pain; who needs laboratory testing, imaging, or emergent referral? Over the last decade imaging studies, particularly CT scanning, have improved our ability to diagnose abdominal pain - CT has been particularly helpful in evaluating patients with possible appendicitis. In order to best utilize imaging tests, the emergency physician (EP) must understand how these studies are performed and understand their limitations.

### II. OVERVIEW OF CASE AND DIFFERENTIAL DIAGNOSIS

This 33 year old patient presented with complaints of right lower quadrant (RLQ) abdominal pain. Possible causes of RLQ pain in a male include appendicitis, diverticulitis (more commonly presents with left sided symptoms), pyelonephritis, bowel obstruction, ureteral calculi, cancer, AAA, testicular torsion, and the ~~ever~~-famous "nonspecific abdominal pain." Urinary tract infection and AAA are very unlikely given the normal urine dip and his young age, respectively. The normal testicular exam removed torsion from the differential diagnosis. The diagnosis of nonspecific abdominal pain can be made only after more serious causes have been eliminated. Lack of prior abdominal surgery makes bowel obstruction less likely, but it is still a remote possibility. The patient's stool history and the quality and presence of bowel sounds is not recorded, but might have been helpful. The remaining diagnoses under consideration include ureteral calculi, appendicitis, nonspecific abdominal pain, bowel obstruction, cancer, and diverticulitis; the last 3 diagnoses are least likely.

### III. LABORATORY TESTING

Laboratory testing is seldom diagnostic in patients with abdominal pain. Lipase and/or amylase are quite good, but not perfect, for the diagnosis of pancreatitis. Urine dip can be helpful in diagnosing urinary tract infection and renal colic but can be misleading; an inflamed appendix overlying the ureter can result in pyuria or hematuria. Similarly, hematuria has been seen with AAA; the most common misdiagnosis made in patients with AAA is renal colic. Conversely, patients with ureteral calculi can present without hematuria.

### IV. GI IMAGING—CT, PLAIN FILMS, ULTRASOUND

The ability of CT to evaluate abdominal pain has dramatically increased with the advent of helical, or spiral scanning, compared to the older method of taking discrete, individual radiographic slices. Helical CT scans have a rotating tube that has multiple x-ray detectors mounted directly across from the source of the x-rays. When the patient moves through the CT scanner, the rotating tube spins around the patient, creating a helical pattern of x-ray beams. Now, the entire abdomen and pelvis can be scanned in less than 30 seconds. This rapid scanning allows all the images to be obtained during

a single breath-hold. The images are reconstructed in 3 dimensions, without concern for unequal breaths causing misregistration, which occurred with conventional CT scanning. Helical scanning collects much more data than conventional scanning and allows for image slice widths of less than 5 mm. This degree of resolution is necessary for detection of tiny objects such as appendicoliths and uroliths.

In the case presented, the EP appropriately decided that further testing was required, and ordered a noncontrast CT scan of the abdomen and pelvis. EPs must decide what question they would like answered before ordering this test, so that the appropriate imaging protocol can be followed. For example, when looking for ureteral calculi, the CT scan should be done without GI or IV contrast since the scan is looking for a radiographically white stone along the course of the ureter. When IV contrast is administered, it will be excreted by the kidney into the ureter, obscuring the stone. Hydronephrosis, if present, will still be evident when IV contrast is used, but hydronephrosis is not always present with symptomatic ureteral calculi.

The optimal protocol for CT scanning for appendicitis has been a matter of debate in the literature in recent years. The standard approach in most hospitals currently is to use IV and oral contrast. The literature suggests that other approaches may be viable, and EPs need to be aware of these issues to best treat the broad range of patients they encounter. For example, IV contrast can cause renal compromise, especially in patients with preexisting renal insufficiency. Oral contrast often requires more than 45 minutes to cause opacification of the appendix; this delay may be acceptable in a 33 year old man with abdominal pain, but is not acceptable when AAA is a possibility.

Other imaging options for patients suspected of having appendicitis include plain radiographs and ultrasound. There are several nonspecific plain film findings in appendicitis such as a focal RLQ ileus (the sentinel loop) or a RLQ soft tissue mass, but the only finding that is specific for appendicitis is an appendicolith. While CT scan can demonstrate an appendicolith in 40–50% of patients with appendicitis, <10% will be evident of plain films; therefore, they are not recommended for the evaluation of suspected appendicitis. The only clear indications for plain abdominal films are for suspected pneumoperitoneum, bowel obstruction, and radiopaque foreign bodies in the GI tract.

Ultrasound has been used for over 20 years to assist in the diagnosis of appendicitis and more than 3 dozen studies have been published in the medical literature looking at its accuracy. It is a technically challenging exam that involves graded compression of the RLQ in search of the appendix. Good analgesia is required to be successful. There are 3 sonographic findings which suggest appendicitis: a noncompressible appendix that has a diameter > 6 mm, the presence of a complex mass in the RLQ, and the presence of an appendicolith. The literature suggests an extremely wide variation exists in the ability of various hospitals to perform ultrasonography accurately for appendicitis. Studies have found that ultrasound can have a sensitivity as low as 36%<sup>18</sup> or as high as 99%.<sup>19</sup> Similarly, specificities range from 68%<sup>19</sup> to 97%.<sup>20</sup> Ultrasonography for appendicitis is a very operator-dependent study that can, in experienced hands, be accurate. In reality, the accuracy of this study is unlikely to surpass that of helical CT scanning, which does not suffer from the poor inter-operator reliability that plagues sonography. Ultrasonography may have a place in the evaluation of pregnant women, and for young children who may not lie still for the CT scan.

## **V. CT FINDINGS WITH APPENDICITIS; SHOULD CONTRAST BE GIVEN, AND HOW?**

CT findings with appendicitis are appendiceal diameter of > 6 mm and periappendiceal inflammatory changes. An appendicolith can be seen in 40–50% of cases. Several studies<sup>1-4</sup> have examined the use of rectal contrast alone for the diagnosis of appendicitis and have found it to be very accurate. The sensitivity of helical CT scans with rectal contrast alone has ranged from 95%–98%.<sup>3-4</sup> Specificities were also good, ranging from 92%–100%. Advantages of this approach include the ability to perform the scan immediately after the contrast is administered (avoiding the 45–60 minute wait required with oral contrast), and lab testing of renal function is not necessary since IV contrast is not used. Other studies have found that CT scanning with no contrast whatsoever is also accurate.<sup>5-10</sup> These studies found the sensitivities of 90% to 96% while the specificities ranged from 85 %–99%. This still means that as many as 10% of those with appendicitis can be missed without contrast. The majority of studies utilizing CT for the diagnosis of appendicitis have used both IV and oral contrast.<sup>4, 11-16</sup> This approach has yielded a range of sensitivities of 91%–100%, the great majority demonstrate a sensitivity of  $\geq 95\%$ . Specificities ranged from 92%–98%. Several authors have examined the economic impact of CT scanning for appendicitis and found it to be a cost-effective test. Rao et al., reported that scanning all patients with possible appendicitis saved \$447 per patient by reducing unnecessary hospitalizations and surgeries.<sup>17</sup> Another group found that CT scanning was cost-effective if the negative appendectomy rate was  $\geq 13\%$ ;<sup>12</sup> most centers report a negative appendectomy rate of approximately 20%.

## **VI. DECISION MAKING WITH NEGATIVE, NONCONTRAST CT**

In the case at hand, the noncontrast CT scan reportedly showed no evidence of appendicitis. This could have been a falsely negative CT scan, or it is possible that the reviewing radiologist looked only for ureteral stones since this was the indication. The CT interpretation stated: “unremarkable helical CT of abdomen and pelvis.” It did not mention if the appendix was even seen. In these situations, it is important to discuss the case with the radiologist, explaining your concerns—additional information may make the difference between an accurate and inaccurate interpretation. If the radiologist still feels the CT is negative for appendicitis, the EP would have 2 options. If the index of suspicion for appendicitis was low, the EP might well decide that the negative noncontrast CT scan lowered the likelihood of appendicitis sufficiently to allow the patient to be discharged. Reexamination should then occur within the next 6–12 hours.

If the level of suspicion is high, a contrast-enhanced scan may be appropriate to improve the sensitivity. Some hospitals routinely perform abdomen/pelvic CT scans with and without contrast to improve accuracy, even though this doubles the radiation dose, to say nothing of the additional cost. In either case, while CT is very accurate, it is not infallible in diagnosing appendicitis. If the EP believes a patient has appendicitis despite an unremarkable CT scan, hospitalization or ED observation is prudent.

## **VII. CT DIAGNOSIS FOR OTHER INTRA-ABDOMINAL CONDITIONS—AORTIC ANEURYSM, DIVERTICULITIS, SMALL BOWEL OBSTRUCTION**

CT scanning has proven valuable in evaluating a number of other conditions that cause abdominal pain. The imaging modality of choice today for ureteral calculi is noncontrast CT scan. CT is both sensitive and specific for this diagnosis. Even stones that have passed from the ureter are usually seen within the bladder. Stones seen within the renal parenchyma are generally not symptomatic, and other causes of pain should be sought in these patients.



Helical CT is also very accurate in diagnosing diverticulitis; it will demonstrate diverticula if they are present and will demonstrate inflammatory changes if diverticulitis is present. While helical CT can be falsely negative early in the disease process, several studies have demonstrated an accuracy of up to 99% when performed only with rectal contrast.<sup>21,22</sup> Traditionally, scans done to evaluate for diverticulitis are performed with oral and IV contrast.

Abdominal aortic aneurysm (AAA) can be rapidly fatal if not diagnosed quickly; the most rapid way to diagnose AAA is with a bedside ultrasound performed by the EP. It is clearly within the scope of EP practice to perform bedside ultrasound exams for evaluation of suspected AAA, abdominal trauma, first trimester pregnancy evaluation, pericardial tamponade, renal colic, and acute biliary disease.<sup>23</sup> When the aorta can be visualized from the diaphragm to its bifurcation, EPs have been found to be extremely accurate in diagnosing AAA in symptomatic patients.<sup>24</sup> The ultrasound exam can be completed in less than 5 minutes, while other interventions are being performed. If the EP cannot perform the ultrasound exam, radiology department ultrasound technicians can come to the ED to perform a bedside exam if they are immediately available. Ultrasound is not accurate in determining if the AAA has ruptured, but the primary question in this clinical setting is whether an aneurysm is present or not. Stable patients can undergo CT scanning, a very accurate method of diagnosing both the size and location of the aneurysm. Intravenous contrast will assist in determining the involvement of any branch vessels, but is not necessary to make the diagnosis of AAA. In emergent situations, when waiting for renal function studies may jeopardize the patient, an immediate noncontrast CT scan will quickly tell the EP whether the patient has an AAA.

CT is also extremely helpful in diagnosing small bowel obstructions. The "obstruction series," consisting of an upright chest, upright abdomen and supine abdomen radiographs, has classically been used to rule in or rule out the diagnosis of a small bowel obstruction (SBO). Unfortunately, plain films are not nearly as accurate as many once believed they were; plain films have been found to be diagnostic in only 50% of SBO's.<sup>25</sup> CT findings include dilation of the bowel proximal to the obstruction and collapse of the bowel distal to the obstruction. When directly compared with plain films, CT has had a better sensitivity (93% vs. 77%) and specificity (100% vs. 50%), and is much more likely to identify the cause of the obstruction (87% vs. 7%).<sup>26</sup> CT scanning with oral and IV contrast should be considered for patients in whom you suspect a SBO but have nondiagnostic films, or whenever the differential includes another diagnosis that can be confirmed by CT (e.g., diverticulitis, AAA).

### **VIII. SUMMARY OF CASE**

In the case presented, it is not clear whether the emergency physician gave serious consideration to the possible diagnosis of appendicitis. The unusual character of the patient's complaints (abnormal urinary stream, intermittent pain, radiation to the right groin) certainly were not typical of appendicitis, but did not remove it from the differential diagnosis. If ureterolithiasis was found, concurrent appendicitis would have been extremely unlikely, but with a negative scan, an explanation of the RLQ pain was still elusive. Given focal tenderness in the right lower quadrant, the emergency physician should have done one of the following: discharge the patient with scheduled reexamination within 6-12 hours, obtain surgical consultation, CT scan with GI and IV contrast, or admission.

## TEACHING POINTS ABOUT CASE 2:

- Men with RLQ pain need to have an evaluation to specifically exclude appendicitis.
- CT scanning of the abdomen is a very accurate, but not perfect, test for appendicitis.
- When patients with continued RLQ pain are discharged, even after a negative CT scan, they need scheduled reexamination within 6–12 hours.
- When employed with the appropriate protocol, CT can be very helpful in diagnosing diverticulitis, AAA, small bowel obstruction, and ureteral lithiasis.

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