

LLSA REVIEW 2017 ARTICLES 5-8

Michael Gratson MD

Human Trafficking

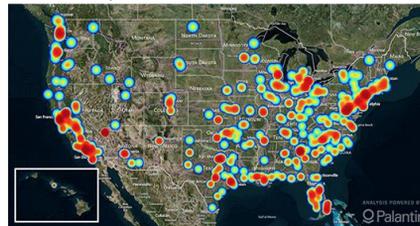
- *Recognizing Victims of Human Trafficking in the Pediatric Emergency Department.*
- Becker HJ, Bechtel K.
- *Pediatric Emerg Care* 2015;31:144-150.
- This is a review article focused on the definition of human trafficking, clinical features that might define a victim, management and treatment, and services for victims.



Defining Human Trafficking

- The United Nations defines human trafficking as:
 - **The recruitment, transfer, harboring or receipt of persons by means of threat or coercion.**
 - **Abduction, fraud, deception, abuse of power to achieve consent is seen.**
 - **Having control over another person for the purpose of exploitation.**
- An estimate of 27 million men, women, children are victims worldwide with only a small fraction identified by governmental agencies.
- Some 18-20,00 are trafficked in the US with the average age in the sex industry being 12-14 years old.
- Profits of \$32 billion a year are seen, now the 2nd largest criminal enterprise surpassing illegal arm sales.

Location of Sex Trafficking Cases Involving U.S. Citizens Reported to NHTRC and BeFree (2014)



Recognizing Human Trafficking in the ED

- Some 30% of victims interact with the healthcare system at some point in their captivity.
- Unlikely they will identify themselves for many reasons including fear, language barriers, and shame.
- They will often be accompanied by the trafficker.
- Red flags that can suggest a trafficking victim include:
 - "Friend or family member" will not allow the patient to be seen alone or answer questions.
 - Vague or inconsistent explanations of injuries or illness.
 - Patient cannot provide an address, no ID, no documents.
 - Avoids eye contact, nervous, flat affect, overtly depressed.



H&P

- Important to separate the patient from the accompanying person.
- Use an interpreter or interpretation service.
- Foster trust by conveying a desire to help.
- Complete physical exam looking for poor hygiene, signs of malnutrition, dental disease, trauma to the skin (burns, bite marks, bruises, traumatic alopecia), unhealed wounds, rashes, poorly healed fractures, ligature marks or signs of physical restraint.
- Genitourinary exam when sexual trafficking is suspected including evidence of untreated STD's, history of pregnancies, genital FB's.



Medical Management

- Priority is any acute or emergent injury or condition.
- Rape kit when indicated, use of SANE practitioners is helpful.
- Female patients need a pregnancy test.
- Testing for STD's including GC, chlamydia, HIV, syphilis, and hepatitis.
- Urine toxicology can be helpful.
- Tb testing can be warranted in victims from outside of the US.
- Pregnancy prophylaxis is suggested to be offered and can be up to 120 hours after last sexual intercourse.

Medical Management

- Patients with PID should be admitted.
- For asymptomatic patients prophylaxis for GC and chlamydia should be given.
- Up to 40-90% of sex trafficking victims are HIV positive and short term and long term management can be necessary.
- Mental health assistance, drug detoxification are longer term treatments that are often necessary in these victims.

Assistance and Reporting

- Engaging social worker is often a key step in having an advocate for the patient.
- For pediatric patients the state child protective services should be contacted.
- It is not uncommon if the trafficker or accompanying person will try to remove the patient by force, local law enforcement can assist and should be contacted.
- Contacting the National Human Trafficking Resource Hot Line (800-373-7888) can help with resources as well.
- For patients who are not US citizens the Trafficking Victims Protection Act of 2000 allows victims to obtain federally funded services, the victim must agree to help law enforcement officials.



Summary

- Human trafficking is a global problem and occurs in the US.
- Victims often come in contact with the healthcare system.
- Clues can include overlooked and untreated medical problems, unexplained traumatic injuries, malnutrition, poor dentition.
- A patient who avoids eye contact, cannot give their address, and has someone accompanying them who will not allow the patient to be examined or answers for the patient can indicate a trafficking victim.
- H&P needs to be complete and thorough including genitourinary exam looking for traumatic injury or infection.

Infection Prevention

- *Infection Prevention in the Emergency Department.*
- Laing SY, Theodora DL, Schuur JD, Marschall J.
- Ann Emerg Med 2014;64:299-313.
- Infection prevention is challenging in the environment of the ED.
- This article reviews the existing literature for infection prevention practices in the ED and what can be done to maximize prevention.



Summary

- Medical management includes testing for STD's, pregnancy prevention, and treatment for injuries.
- Patients should be treated for active or suspected STD's, pregnancy prophylaxis, and HIV in many cases.
- Engaging a patient advocate, making sure the patient is not taken out of the ED, and obtaining state/Federal/local assistance for victims has to be a high priority.

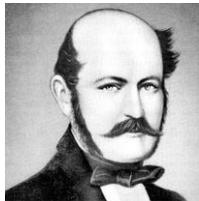
Infection Prevention

- Clearly the challenges to infection prevention in the ED are varied:
 - Complex and dynamic environment.
 - An environment with rapid turnover of patients often precluding intense cleaning of an ED cubicle with each change of patient.
 - Patients are undifferentiated in illness and variable acuity.
 - Patients are at close proximity.
- The article address prevention through 2 themes: **preventing transmission** from patients to ED personnel and other patients, and **reducing the risk** of infection while receiving care in the ED.



Preventing Transmission – Hand Hygiene

- In 1847 Ignaz Semmelweis 1st recognized that the simple act of hand washing substantially reduced the spread to endometritis in patients in labor.
- To this day this cornerstone of infection prevention remains relevant.
- Not only does resident bacteria colonize the skin (coag-negative Staph) but transient flora picked up through patient contact can reside on the skin including Staph aureus, Enterococcus, gram negative bacilli, C. Diff among others.
- All of which have been shown to be capable of being transmitted to other patients.



Ignaz Semmelweis (1818-1865)

Preventing Transmission – Hand Hygiene

- Hand hygiene has been shown to eliminate transient flora including alcohol based gels and foams.
- For C. diff washing with soap and water is necessary.
- Studies in both the ICU and ED have shown poor adherence (10-90%) to hand hygiene due to lack of time, high patient load, urgent clinical situations, caring for patients in the hallways, overcrowding.
- Interventions have met with varied success ranging from posting signs, educational sessions, use of touch-free or personal hand sanitizing dispensers.
- Large multifaceted interventions seem to show the best results with nurse/physician champions, improved access, and monitoring.

Preventing Transmission – Standard Precautions

- ED personnel frequently come in contact with blood and other infectious body fluids.
- Standard precautions mandate the use of barriers, masks, eye protection, gowns, and gloves.
- Hand and respiratory precautions would also be included in this.
- These universal precautions have been the best studies of all the modalities to prevent infection transmission.
- Use in the ED has been found to vary from 38-89% most often discarded due to clinical urgency.



Preventing Transmission – Standard Precautions

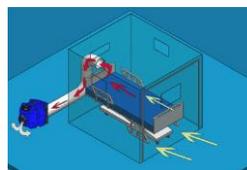
- Barriers to routine hand washing and use of barriers include time, patient load, overcrowding, access to supplies, and lack of time.
- Interventions do improve adherence including educational sessions, small group discussions, visual reminders at the bedside, supply access, monitoring, and threat of sanctions.
- The best means of increasing adherence seem obvious including ready access to equipment, frequent reminders, routine monitoring to reinforce the use of protective barriers.

Preventing Transmission – Airborne Precautions

- Airborne droplets can be as small as 5 microns such that they remain suspended in the air for hours.
- Transmission of Tb, measles, ARDS, varicella, influenza can all be transmitted by airborne particles.
- The best means of protection is an N95 mask or power respirator both of which have low adherence due to poor availability or lack of appropriate fit testing.
- Single-occupancy negative pressure rooms are expensive and vary in availability in the ED making airborne precautions particularly challenging.

Preventing Transmission – Droplet Precautions

- Droplets are larger particles > 5 microns that do not travel or remain suspended in air.
- Transmission occurs with seasonal influenza and meningococcal infections along with H. flu, group A Strep, Bordetella pertussis, and large group of respiratory viruses.
- Wearing a surgical mask is part of the standard precautions if one is within 6-10 feet of an infected patient.
- **Cohorting patients** during outbreaks is also recommended.
- As expected, studies show less than optimal use of gloves and masks in the ED when treating patients with influenza-type illnesses.



Preventing Transmission – Droplet Precautions

- The physical/social distancing of the use of the masks and isolation has not been well studied but is felt to influence the patient/physician relationship.
- Multifaceted programs including signage about cough etiquette, improved access to supplies, masking and separating patients with respiratory symptoms, and ED personnel adhering to droplet precautions has been shown to reduce transmission.



Preventing Transmission – Contact Precautions

- ED personnel care for patients infected or colonized with multi-drug resistant organisms including MRSA, vancomycin resistant Enterococcus, drug resistant gram-negative bacteria, C. diff, and other pathogens.
- Use of barriers, gloves and gowns, can help but it is not always obvious aside from the patient with diarrheal illnesses when to use them.
- Flagging in the EMR has been suggested as a way to improve use of contact precautions along with the other suggestions of access to supplies, time, patient crowding or in hallways.

Preventing Transmission – Immunization

- Health care personnel immunization is felt to be an important strategy to protect those who work in a hospital against vaccine preventable infections.
- Historically the rate of influenza vaccination in ED personnel has been surprisingly low (though many hospitals are making this a requirement to work).
- It is recommended by the authors that all persons > 6 months old without clear medical contraindications have the influenza vaccination.

Preventing Transmission – Environmental Controls

- The places that can get contaminated in the ED abound making proper cleaning an aspect of infection transmission can be reduced.
- From gowns, linens, to guard rails and overbed table tops, to BP cuffs, and the floor are all surfaces that get contaminated need cleaning.
- CDC has guidelines for low level decontamination of non-critical equipment like BP cuffs and bedrail and other surfaces that should be cleaned between all patient contacts.
- Limited evidence supports cleaning high touch items such chairs, exam tables, and curtains but is often minimal in most ED's.
- MRSA has been found on computer keyboards and mice, phones, and door keypads and they are not cleaned on a regular basis.

Health-Care Associated Infections

- The authors cite that **1 in 20 patients** in the US will develop a health-care associated infection during their course of hospitalization with ~ 100,000 deaths per year.
- Central lines, urinary catheters, ventilator associated pneumonia (VAP), and medical devices account for a substantial number of such infections.
- The authors examine these three aspects of infection, their etiology, and potential for prevention.

Central line Bloodstream Infection

- Central line associated bloodstream infections (CLABIs) have a mortality reported as high as 30%, extend ICU and hospital LOS, and cost up to \$2 billion a year.
- A single study from 2010 focused on CLABI attributed to the ED found the rate similar to that of the ICU in an academic center.
- In that study the rate was 1.93/1,000 catheter days and whether this finding can be generalized is not known.
- Prevention has focused on aseptic technique with adherence rates ranging from 33-86% on video based assessment.
- Successful programs have focused on hand hygiene, barriers and drapes, gowns/masks/caps/gloves, chlorhexidine skin cleansing, and standardized central line kits.



Peripheral Catheter Infections

- Infections secondary to peripheral IV catheters is low with a study looking at Staph aureus bacteremia found a rate of 0.07/1,000 catheter days.
- Given the low occurrence rate it comes as no surprise that studies have shown poor compliance with sterile technique and line care in the ED despite the fact that 50% of infections are from lines placed in the ED.

Urinary Catheter Infections

- Catheter associated UTI's are common given that such catheters are frequently placed in the ED, often left in for long periods of time, as such they become colonized leading to UTI and even sepsis.
- An estimated 65-70% of catheter associated UTI's are preventable.
- In a study in an ED 73% of 277 patients who had a Foley placed were > 65 years old, 24 developed catheter associated UTI's, 11 were felt to be due to inappropriate catheter use.
- Studies of educational programs for ED nurses and physicians for this type of UTI resulted in an 80% reduction in urinary catheter insertions.
- Similar programs aimed at residents have show less improvement.

Catheter-Associated Bacteriuria

- Bacteriuria rate: 5% per day
- Organisms enter mainly by extraluminal route
- Biofilm on outside of catheter
- Polymicrobial, changing flora
- Antibiotic prophylaxis: no value

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Urinary Catheter Infections

- Multidisciplinary programs focusing on appropriate use of urinary catheters, early removal, frequent monitoring of the use of catheters, resident education have been successful in reducing catheter related UTI's.
- Such reductions have been seen and sustained hospital-wide if attention is paid to careful implementation of programs to reduce catheter use and to reduce the number of days patients have such catheters.

[presenter's note: catheter induced UTI's are a major CMS quality measure with significant monetary implications.]

VAP

- Ventilator associated pneumonia (VAP) is defined as a pneumonia that occurs > 48 hours after being on ventilator that was not present prior to intubation.
- It carries a high mortality and is not typically seen by emergency physicians as the patient is well past the time they were in the ED.
- Trauma patients intubated in the ED or those intubated in the prehospital setting a particularly at risk for a VAP.
- Some 50% of VAP is felt to be preventable and simple, low-cost strategies have been found to reduce its incidence.
- **These include elevating the head of the bed to 30 degrees, ETT's with a suction port above the balloon, oral hygiene with hydrogen peroxide, and of course limiting the duration of intubation as much as possible.**



Other Medical Device Sources of Infection

- Ultrasound has now become common in many ED's.
- The probes can and often carry significant pathogens and seen in 70% of cultures from probes in the ED including MRSA.
- Appropriate disinfection with antimicrobial wipes is very effective in removing contaminants like MRSA from US probes.
- Transvaginal endocavitary probes have been found to carry human papillomavirus in 7.5% of surveillance PCR probes.
- Routine disinfection guidelines and practices are suggested as necessary components of an ultrasound program in the ED.

Summary

- There are many opportunities for improving infection control in the ED.
- Challenges just due to the nature of ED patient traffic, clinical demands, critically ill patients, crowding and hallway patients, and resources devoted to disinfection practices are significant barriers.
- ED design and structure can be improved to provide easier and ready access to necessary equipment including gloves, hand hygiene gels or foams, sinks to wash in, masks/gowns/barriers for procedures, specialty masks for airborne contaminants, and use of masks on patients and staff to reduce droplet borne infection.

Summary

- Immunization of ED personnel is a recognized and encouraged practice for both the safety of said personnel and to reduce spread of illnesses such as influenza.
- Practices to reduce central line bloodstream infections are also recommended including sterile barriers and complete sterile gown/glove/mask/caps on the physicians inserting the lines.
- Urinary catheter associated UTI's can first and foremost be reduced by careful selection of patients in whom to insert a Foley and frequent reassessment so it is removed at the earliest opportunity.
- Better and more thorough cleaning of the furniture and beds in the ED can also reduce infection transmission.

Summary

- Ready identification of potentially infected patients particularly with the use of the EMR can improve infection control.
- For VAP prevention simple low-risk maneuvers in the ED may reduce the incidence such as elevating the head of the bed, using endotracheal tubes with a suction port just above the balloon, or frequent oral suctioning.
- Disinfection of ultrasound probes, particularly the endocavitary probe, between each patient should be a routine practice.
- Reinforcement of good infection control practices can include education sessions, active monitoring of the ED personnel, check-lists, attention to making such practices a part of the ED culture.

Summary

- New methods of infection surveillance with such things as molecular diagnostics may hopefully improve screening and diagnosis of infections in the ED such as influenza or Tb.
- While the role of the ED in preventing the spread of infection is going to grow current methods and novel approaches need to be studied so best practices can be defined.
- Antimicrobial stewardship is another area that has the potential to reduce the inappropriate use of antibiotics and preventing the development of drug-resistance bacterial strains.
- As always innovation and creativity are at the core of emergency medicine and will be fertile ground for future research in this area.

Lyme Disease

- [Lyme Disease](#)
- Shapiro ED.
- NEJM 2014;370:1724-1731.
- This was a review of Lyme disease, its presentation, work-up, and treatment that started with a case presentation to illustrate the points outlined by Dr. Shapiro who is from Yale University School of Medicine, the Department of Pediatrics and is also in the Public Health and Epidemiology Department.



The Case

- A 32 y/o 26 week pregnant patient from SE Connecticut presents with a skin lesion. She also complains of fatigue, arthralgias, headache for 2 days along with an axillary rash. She lives in a wooded area and removed a tick from behind her knee 6 weeks earlier. On exam the only finding is an erythematous, oval, macular, 7-8 cm lesion in the left axillae with enhanced central erythema.
- Given the title of the article this just shouts Lyme disease.

Lyme

- This eponymous disease first identified in Lyme, Connecticut is a zoonosis transmitted by a number of *Ixodid* ticks that transmit the spirochete *Borrelia burgdorferi*.
- The most common sign is a single (80%) erythema migrans (EM) papule that develops at the bite site some 1-2 weeks after the bite and gets larger with time.
- The lesion can have central vesicles or a necrotic region, is often asymptomatic or just mildly pruritic, and lasts for 3-4 weeks.
- It can occur anywhere on the body and while the *bull's-eye* description is classic some 2/3's are uniformly erythematous or have an enhanced reddening in the central area.
- Non-specific symptoms of fatigue, headache, arthralgia, myalgia, and less often fever occur in many patients.



Disseminated Disease Symptoms

- The most common sign of early disseminated disease is multiple, usually smaller EM lesions.
- Other signs can include:
 - neurologic symptoms including cranial nerve palsy (particularly the facial nerve, bilateral Bell's = Lyme)
 - aseptic meningitis
 - carditis manifested as heart block
 - arthritis particularly in the knee as a rather late sign weeks to months after the initial infection occurring in 10%



Incidence

- While 10,000 cases were reported in 1992 now 25-30,000 cases a year are seen.
- The majority are in the New England and Mid-Atlantic states with cases also in Wisconsin and Minnesota, on the west coast Oregon and northern California are seeing Lyme disease as well.
- Children 5-14 years old and middle-aged adults 40-50 years old have the highest incidence.
- The natural reservoir for *B. burgdorferi* are chipmunks, small mammals, and birds with deer being the host for the *Ixodes scapularis* (deer tick) that transmit the disease (*I. pacificus* on the west coast).

Diagnosis

- To a large extent it is history that makes the diagnosis along with the character of the rash.
- Serologic tests are of little clinical use in patients with EM but if done a 2-tier serologic study of an ELISA screening test that if positive or equivocal is confirmed with a Western blot test is the recommended methodology.
- The tests are poorly sensitive during the acute phase (20-40%) with a high false positive rate of 50% and even in the convalescent phase may not have a positive test.
- The best sensitivity is in patients with disseminated neurologic or cardiac disease (80-100%).
- As IgG/IgM antibodies persist for years so their presence is an indication of previous exposure and not necessarily active disease.

Treatment

- Treatment is with antibiotics with 90% cures with doxycycline, amoxicillin, or cefuroxime and macrolides for patients who cannot take either of those 3 agents are less effective.
- Patients who are not cured tend to have non-specific symptoms such as fatigue and joint pains.
- Trials typically treated patients for 10-14 days with even a study of disseminated disease treated with 14 days of ceftriaxone or 21 days of doxycycline showing no difference in cure rates.
- Some 15% of patients will have a sort of Jarisch-Herxheimer reaction consisting of fever, myalgia, arthralgia within 24 hours of starting the antibiotics that resolves in 24-48 hours; one can use NSAID's to treat this.

Treatment

- Erythema migrans:
 - Doxycycline – 100mg BID in patients > 8 y/o/non-pregnant x 14 days.
 - Amoxicillin – 500mg TID, 50 mg/kg peds dose x 14 days.
 - Cefuroxime – 500mg BID, 30 mg/kg peds dose x 14 days.
- Meningitis:
 - Ceftriaxone – 1gm IV BID, 50-75 mg/kg peds dose x 14 days.
 - Cefotaxime – 2gms IV TID, 150-200 mg/kg peds dose x 14 days.
- Cranial nerve palsy without evidence of meningitis, carditis, and arthritis would be treated with the same agents and doses as EM.

Prevention

- Don't go to places that have the disease!
- 20% DEET repellents, long pants and shirts can reduce tick bites.
- Checking clothing, close skin inspections, and bathing within 2 hours of exposure can be effective in reducing tick bites studies indicate that it takes 36-48 hours of attachment for the nymphal stage and >48 hours for the adult tick to effect transmission.
- A vaccine was an idea that did not pan out commercially.
- A study of patients > 12 years old given a single 200mg of doxycycline within 72 hours after removal of a tick was 87% effective in preventing Lyme disease.
- But a meta-analysis found the NNT was 50 to prevent 1 case of EM so prophylaxis is not recommended by these authors.



Post-Lyme Syndrome

- A minority of patients treated with antibiotics have resolution of the objective signs but have persistent fatigue, arthralgias, and myalgias for weeks afterwards.
- The cause is unclear but prolonged antibiotic treatment has minimal to no benefit despite the lurid press misinformation that is disseminated.
- In patients with ≥ 2 episodes of Lyme separated by years studies have shown that they were separate strains so again prolonged antibiotic therapy is not recommended.



Case Conclusion

- In the presented case the patient had a lesion consistent with EM 6 weeks post tick bite.
- As she is pregnant treatment with amoxicillin 500mg TID x 14 days is the recommended treatment as doxycycline is contraindicated in pregnant patients and those < 8 years old.
- The author would also caution the patient regarding rampant misinformation on the Internet.

Summary

- Lyme disease is a bacterial infection cause of *B. burgdorferi* transmitted by the *Ixodes* deer tick primarily in the New England and Mid-Atlantic states with infections also seen in MN,WS, along with northern CA and OR.
- The diagnosis is essentially clinical based on risks and the presence of usually a single erythema migrans lesion that may not be the classic bull's-eye description, more often uniformly erythematous or with an enhanced central erythema.
- Associated non-specific symptoms of fatigue, arthralgias, myalgias, and occasionally fever are also seen.
- Disseminated disease can be heralded by a diffuse EM rash, cranial nerve palsy, arthritis, or carditis.

Summary

- Serologic testing is not routinely recommended, is more likely to be accurate in disseminated disease, and is unhelpful in the ED.
- Antibiotics are the mainstay of treatment with amoxicillin, doxycycline, and cefuroxime being the most commonly used, found to be highly effective, and 10-14day course is typical.
- Prevention is by avoiding tick bites, use of DEET insect repellent, wearing long pants and shirts, and careful inspection of the skin and clothing when in deer tick territory.
- Transmission takes some 1-2 days by the tick, prophylaxis with doxycycline 200mg within 72 hours of a tick bite has shown to reduce infection but is not currently recommended.
- There is no evidence that persistent symptoms are helped with prolonged antibiotics.

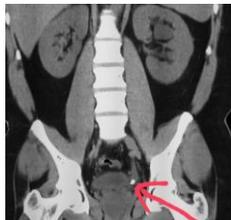
Nephrolithiasis – CT vs. US

- *Ultrasonography versus Computed Tomography for Suspected Nephrolithiasis.*
- Smith-Bindman R, Aubin C, Bailitz J, et al.
- NEJM 2014;371:1100-1110.
- This was a "pragmatic comparative effectiveness trial" of patients 18-76 y/o with suspected kidney stones who had a POC ultrasound by the EM physician, an ultrasound by a radiologist, or an abdominal CT in 15 academic ED's.



Secondary Outcomes

- **Secondary Outcomes included:**
 - Serious adverse events including those related to participation in the study.
 - Return to the ED or hospitalizations.
 - Self-reported pain scores.
 - Diagnostic accuracy.
- Adverse events attributable to participation in the study included those that delayed the diagnosis of acute cholecystitis, appendicitis, and bowel obstruction.
- For diagnosis accuracy the reference standard was by patient report of stone passage or surgical removal of a stone.



Methods and Outcomes

- In 15 academic ED's patients between 18-76 years old with symptoms of renal colic underwent imaging in a 1:1:1 randomization to the three modalities between 2011 – 2013.
- **Primary outcomes:**
 - High-risk diagnoses with complications that could be related to missed or delayed diagnosis.
 - Cumulative radiation exposure.
 - Total costs.
- **High risk diagnoses** included AAA with rupture, pneumonia with sepsis, appendicitis with rupture, diverticulitis with abscess/sepsis, bowel ischemia or perforation, renal infarction, renal stone with abscess, pyelonephritis with sepsis, ovarian torsion with necrosis, or aortic dissection with ischemia within 30 days of the index ED visit.

Patient Enrollment

- 3638 patients were screened, 3100 felt to be eligible, 2776 were randomized but 17 later excluded – 2759 patients were available for analysis.
- Random assignments had 908 patients in POC ultrasound, 893 radiologist US, and 958 in the abdominal CT group.
- 113 patients were lost to follow-up.
- Overall this was felt to be a highly effective and even randomization and patient follow-up.

History and Physical Exam

- 41.6% of patients had a history of kidney stones, 63.3% related hematuria, and 52.5% complained of CVA tenderness.
- Exam findings that suggested other problems included:
 - Acute cholecystitis – 1.3%
 - Appendicitis – 3.6%
 - Judged to have a high risk for aortic aneurysm 0.8%
 - Judged to be at high risk for appendicitis 3.1%
 - Judged to be at high risk for bowel obstruction 3.6%

Complications, Adverse Events, Radiation

- After 30 days high risk complications were recorded in 11 patients: 6 in POC ED US group, 3 in radiology US group, and 2 in CT group, while there were 5 deaths none were felt to be do to participating in the study.
- No differences were seen in the number of serious adverse events between the different imaging groups with 113 in the POC ED US, 96 in the radiology US group, and 107 in the CT group ranging from 10.8-12.4%.
- Of course higher radiation exposure occurred in the CT group and lower in the US groups.
- Exposure measurements were 17.2mSv in the CT group vs. 10.1 and 9.3mSv in the two US groups as CT imaging was done in some of the US group patients.

LOS and Pain Scores

- ED LOS was highest for the radiology US group at 7 hours compared to 6.3 hours in the POC ED US group and 6.4 hours in the CT group.
- There were no significant differences in pain scores between the groups at EC discharge and at 3 and 7 day follow-ups averaging in the the 3/10 range.
- There were also no differences in the groups with the rates of return to the ED, at 7 and 30 days and admission to the hospital at 7 to 180 days.

Diagnostic Accuracy

- The proportion of patients with a confirms stone seen or removed surgically was similar between the 3 imaging groups:
 - 34.5% in the POC ED US group.
 - 31.2% in the radiologist performed US.
 - 32.7% in the CT group.
- The 2 US groups were more likely to undergo additional imaging with CT's performed in 47% and 27% of the ED and radiologist performed US patients with only 5.1% of CT patients undergoing an US.
- Total costs were a bit lower for the US groups compared to CT with a difference of a mere \$25.

Diagnostic Accuracy

Study	Sensitivity	Sensitivity
ED POC US	54%	71%
Radiologist US	57%	73%
CT	88%	58%

Summary

- Patients who undergo US for suspected nephrolithiasis were exposed to lower radiation without a difference in high-risk complications and total serious adverse event.
- CT had the expected greater sensitivity but that did not translate into better patient outcomes with the reference standard being quite stringent.
- This study did not support that patients should only undergo US studies but it should used as the initial diagnostic imaging exam with further imaging at the discretion of the EM physician.
- CT following an US study varied across the study sites with the reasons for obtaining that additional study being unclear.

Summary

- The use of CT for renal stones has increased 10x in the past 15 years.
- Using US as the initial test with other testing as needed resulted in:
 - No need for CT in most patients.
 - Lower radiation exposure.
 - No significant differences in the risk of subsequent serious adverse event, pain scores, return to the ED, and hospitalizations.