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TELERADIOLOGY INTERPRETATIONS OF EMERGENCY DEPARTMENT COMPUTED TOMOGRAPHY SCANS

Timothy F. Platts-Mills, MD,[1] Gregory W. Hendey, MD, and Brian Ferguson, BS

Department of Emergency Medicine, University of California San Francisco-Fresno, Fresno, California
Corresponding Address: Timothy F. Platts-Mills, MD, Department of Emergency Medicine, University of North Carolina at Chapel Hill, 170 Manning Drive CB#7594, Chapel Hill, NC 27599-7594

☐ **Abstract—Background: Teleradiologist interpretation of radiographic studies during after-hours Emergency Department (ED) care has the potential to influence patient management. Study Objectives: We sought to characterize frequencies of discrepancies between teleradiology and in-house radiology interpretations for computed tomography (CT) scans. Methods: We conducted a prospective observational study comparing teleradiologist and in-house radiologist interpretations of CT scans obtained between 7:00 p.m. and 7:00 a.m. from the ED at a Level I trauma center. For each scan, discrepancies were characterized as major, minor, or no discrepancy. Follow-up data were used to characterize major discrepancies. Results: Of 787 studies sent to teleradiology, 550 were scans of the head, cervical spine, chest, or abdomen and pelvis. Major discrepancies were identified in 32 of 550 studies (5.8%; 95% confidence interval 4.1%–8.1%), including 7 of 160 head CT scans, 1 of 29 cervical spine CT scans, 3 of 64 chest CT scans, and 21 of 297 abdominopelvic CT scans. We attributed 8 of the 32 major discrepancies to a teleradiology misinterpretation, with one case leading to an adverse event. Conclusions: We identified major discrepancies due to teleradiologist misinterpretation in 8 of 550 studies, with one patient suffering an adverse event. Our findings support the cautious use of teleradiology interpretations. © 2010 Elsevier Inc.**

☐ **Keywords—teleradiology; diagnosis; diagnostic errors; emergency medicine; computed tomography**

[1]Current affiliation: Department of Emergency Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC.

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INTRODUCTION

Teleradiology groups have become the standard means by which Emergency Physicians obtain after-hours interpretations of non-plain film images in the United States. A 2004 survey found that 82% of private community Emergency Departments (EDs) in the United States rely on teleradiology services for nighttime image interpretation (1). Because most non-teaching radiology groups find it difficult to provide 24-h radiology coverage, teleradiologists will likely continue to play an important role in after-hours image interpretation (2). Arrangements between EDs, in-house radiology, and teleradiology services vary, but most relationships include an in-house radiologist review of teleradiologist interpretations to provide a final interpretation for quality assurance.

Although Emergency Physicians and consultants may view studies themselves, they often rely on teleradiologist interpretations to make important clinical decisions. Because these decisions are often made before the availability of the final interpretation, misinterpretations by teleradiologists could lead to significant, inappropriate changes in patient management.

Teleradiologist interpretations may differ from those of in-house radiologists for a number of reasons. First,

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although several studies have shown that transmitted images have preserved quality, in some systems there may be a difference in the quality of images available to the teleradiologists and the in-house radiologists (3–6). Second, teleradiologists practicing in the United States almost always work at night and sometimes at home; teleradiologists working outside the United States also may have a different work environment than that of in-house radiologists. Third, teleradiologists typically do not have access to additional information, including prior studies, plain films, or clinical data, which may assist in-house radiologists in image interpretation. Finally, interobserver variation among radiologists occurs for all study types and may be the predominant source of discrepancies between in-house and remote teleradiologists (6,7).

Four studies have sought to characterize discrepancies between teleradiologists and in-house radiologists, with estimates of the frequency of major discrepancies ranging from 1.5% to 5% (3–6). These studies examined relationships between teleradiology and in-house radiology that differ from the typical relationship used in community practice today. Two studies relied upon radiology resident interpretations for the remote read (3,4). Two other studies were designed primarily to test the technology of image transmission and used the same radiology group for both in-house and remote interpretations (5,6). We were unable to find any published studies that characterize discrepancy frequencies between a private, commercially available teleradiologist group and an in-house radiologist group.

The purpose of this study was to provide an estimate of the frequency of major discrepancies between a teleradiology group and an in-house radiology group for four commonly ordered computed tomography (CT) scans. Additionally, we classified discrepancies as over-reads or under-reads by the teleradiologist or in-house radiologist and reviewed all major discrepancies to determine if an adverse event could be attributed to the discrepancy.

MATERIAL AND METHODS

Study Design

We conducted a prospective observational study comparing teleradiologist and in-house radiologist interpretations of all CT scans of the head, chest, cervical spine, and abdomen and pelvis obtained from the ED between 7:00 p.m. and 7:00 a.m. during a 3-month period between November 1, 2004 and January 31, 2005. The study was approved by the hospital's institutional review board and a waiver of patient authorization was obtained.

Study Setting and Population

The study was conducted at an academic Level I trauma center with an Emergency Medicine residency but without a Radiology residency. The ED has an annual census of approximately 65,000. During the study period, as is routine practice, films were sent to the teleradiology group between the hours of 7:00 p.m. and 7:00 a.m. Digitized data were compressed before transmission using WinRAR™ (Win.rar GmbH, Berlin, Germany) gateway software, which uses a lossy compression system. This method of data manipulation is in compliance with the American College of Radiology's technical standard of electronic imaging (8). Teleradiologists had the same ability to manipulate images as was available to in-house radiologists. Clinical information was provided to the teleradiologist by the treating physician and typically limited to a few words (e.g., abdominal stab wound). Teleradiologists did not have access to old films for the purpose of comparison. Interpretations were made available to treating clinicians via both facsimile and by the teleradiology group's website. A telephone call was made by the teleradiologist to the treating clinician for studies in which significant pathology was identified. Teleradiologists were available for telephone consultation at the discretion of the treating physician. No modifications were made to the existing relationship between Emergency Physicians and teleradiologists during the study period.

The teleradiology group is a company based in Los Angeles with contracts to provide overnight services to 52 hospitals in the western United States. At the time of the study, the company employed eight licensed, US-trained and board-certified general radiologists, with three or four radiologists reading approximately 350 studies each night.

The in-house radiology group is composed of 22 licensed, US-trained and board-certified radiologists who provide services to four hospitals. As is routine practice, during the 3-month study period, in-house radiologists reviewed both the images and the teleradiology interpretation before providing an official interpretation of the images. The in-house radiologist was not blinded to the teleradiologist interpretation. In-house radiologists were typically provided with the same clinical information as was provided to the teleradiologist. However, in-house radiologists had the opportunity to obtain additional information through computer records, viewing other images, and discussion with other care providers. We did not restrict or quantify in-house radiologist access to additional clinical information. Changes in interpretations made by the in-house radiologist were reported to the treating physician at the time of identification.

Image Selection

We evaluated interpretations of four types of CT scans ordered from our ED. CT scans of the head included studies both with and without contrast, but did not include orbital or maxillofacial CT scans. CT scans of the cervical spine included only those obtained to evaluate for cervical spine injury and did not include CTs obtained to evaluate the soft tissues of the neck. CT scans of the chest included both standard chest CT scans done either with or without contrast and CT pulmonary angiogram studies obtained to evaluate for pulmonary embolism. CT scans of the abdomen and pelvis included standard abdomen and pelvis CT scans with or without oral or intravenous contrast, as well as renal CT studies obtained to evaluate for ureterolithiasis and hydronephrosis. Dedicated pelvic CT scans, typically obtained to evaluate pelvic and proximal femur fractures, were not included in the study. A 4-slice CT scanner (Siemens Sensation 4; Siemens, Malvern, PA) was used to acquire images.

Images sent to the teleradiology group during the study period but not evaluated in our study included magnetic resonance imaging (MRI), ultrasound, non-study CT scans, and CT scans obtained for patients already admitted to the hospital. We chose not to include pelvic CTs and maxillofacial CTs because usually these films are ordered at the request of a consulting service and rarely change Emergency Physician decision-making. We chose not to include MRI studies and soft-tissue neck CT scans because these studies are performed too infrequently to allow calculation of meaningful discrepancy frequencies during a 3-month collection period. Rather, we chose to focus our attention on commonly ordered CT scans. We did not evaluate plain film interpretations because plain films interpretation is not a service provided by the teleradiology company to our hospital.

Study Protocol

Each morning during the study period, a list was made by the Radiology Department of all studies and interpretations provided by the teleradiology group during the previous evening. These interpretations were compared to the official interpretation by the in-house radiologist obtained from the hospital computer system by one of the study authors (TP). Following a format used in prior studies to evaluate discrepancies in the interpretation of radiologic images, interpretations were classified as either no discrepancy, minor discrepancy, or major discrepancy (5,6).

A major discrepancy was defined as a discrepancy that might reasonably be expected to alter the patient's disposition, the need for consultation or intervention, or medical treatment during the ED visit. Minor discrepancies included discrepancies that would be unlikely to alter patient care during the ED visit. Radiographic interpretations in which a diagnosis was suggested or described as probable was considered to be positive; interpretations in which no pathology was described but a finding could not be excluded were considered to be negative. Although patient outcome data were subsequently reviewed to further characterize major discrepancies, outcome data were not used in the initial categorization of pairs of interpretations as major, minor, or no discrepancy.

To assess the validity of the process by which pairs of interpretations were classified as major or minor discrepancies, a second author (GH) provided a blinded review of 50 major and minor discrepancies. The second author was blinded to the classifications made by the first reviewer and was provided with only the two interpretations for each CT scan and the definitions of major and minor discrepancies.

After the classification of discrepancies, we reviewed discharge summaries and subsequent ED and clinic visits of all major discrepancies to define them as over-reads or under-reads by teleradiology or in-house radiology. The characterization of major discrepancies as either over-reads or under-reads was done by consensus of the authors. In some cases, it was not possible to make this determination because the patient's clinical course was consistent with either of the interpretations.

A second chart review was conducted of all cases in which a major discrepancy was identified to determine if an adverse patient event actually resulted from the discrepancy. An adverse patient event was defined broadly to include death, loss of limb or functional capacity, call back to the ED, or subsequent admission or operative intervention that could be described as a delay in care for a problem related to the image interpretation discrepancy. This chart review was conducted by a single author (TP) and included a review of progress notes, discharge summaries, and clinic visits. For patients without further documentation in the medical record, telephone call follow-up was used to assess for the occurrence of an adverse event. To be considered to not have had an adverse event, patients had to have clear documentation of being well in regard to the discrepant finding at least 1 month after the time of imaging and not have required additional or altered care during that month to address pathology related to the discrepancy.

Data Analysis

Sample size was estimated to provide an overall frequency of major discrepancies with a margin of error of $\pm$ 1%.

Using a predicted major discrepancy frequency of 2% and requiring a 95% confidence interval and a power of 80%, this required 765 pairs of interpretations. Based on current usage of teleradiology services, we anticipated enrollment of 10 pairs of study interpretations each day. Allowing for variance in enrollment and lost or incomplete data, we estimated that sufficient cases would be obtained in 3 months.

The percentage of major discrepancies for each type of CT scan was calculated with 95% confidence intervals. Confidence intervals were calculated using exact methods (9). A kappa statistic was calculated to assess the degree of agreement between the two authors' assessment of major and minor discrepancies.

RESULTS

During the 3-month study period, 787 studies were sent to teleradiology for evaluation. Of these, 550 studies were CT scans of the head, cervical spine, chest, or abdomen and pelvis. The types of studies and the number of discrepancies for each type are illustrated in Figure 1. Major discrepancies were identified in 32 of 550 studies (5.8%; 95% CI 4.1–8.1%), including 7 of 160 head CTs (4.4%; 95% CI 2.2–8.8%), 1 of 29 cervical spine CTs (3.4%; 95% CI 0.8–17.2%), 3 of 64 chest CTs (4.7%; 95% CI 1.7–12.9%), and 21 of 297 abdominopelvic CTs (7.1%, 95% CI 4.7–10.6%). All major discrepancies are listed in Table 1.

Minor discrepancies were identified in 116 of 550 studies (21.1%; 95% CI 17.9–24.7%), including 25 of 160 head CTs (15.6%; 95% CI 10.8–22.1%), 5 of 29 cervical spine CTs (17.2%; 95% CI 7.7–34.7%), 14 of 64 chest CTs (21.9%; 95% CI 13.5–33.5%), and 72 of 297 abdominopelvic CTs (24.2%; 95% CI 19.7–29.4%). The most common minor discrepancies involved renal or hepatic cysts, pulmonary nodules, or non-acute intraparenchymal brain findings. Most minor discrepancies resulted from an in-house radiologist describing a finding that was not mentioned by the teleradiologist.

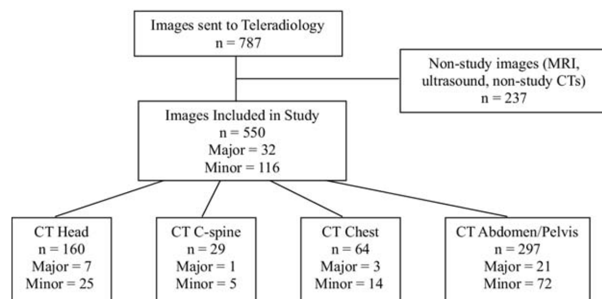

Figure 1. Images sent to teleradiology during the 3-month study period (Major = major discrepancy; Minor = minor discrepancy; MRI = magnetic resonance imaging; CT = computed tomography).

The second author's classification of pairs of images agreed with the first author's classification for 47 of 50 images, yielding a percent agreement of 94%. The kappa statistic for these two sets of classification was 0.865. Each of the three disagreements between the two authors was classified as major by the first author and minor by the second author. For the purpose of analysis, these three pairs of interpretations were reported as major discrepancies.

Eight of the 32 major discrepancies were attributed to misinterpretations by teleradiologists; nine were attributed to misinterpretations by in-house radiologists. We were unable to classify 15 discrepancies. Of the eight misinterpretations by teleradiologists, four were over-reads and four were under-reads. Two of the four over-reads by teleradiology led to an admission that would probably otherwise have been unnecessary. One inappropriate admission was based on the teleradiologist identification of a pulmonary embolism; the other was for a concerning head CT finding. In both cases, the patient was discharged the next day after the in-house radiologist provided a different interpretation than that provided by the teleradiologist. Two other teleradiology over-reads occurred in patients who required admission regardless of the presence or absence of CT findings.

Of the 4 patients for whom the discrepancy was classified as an under-read by teleradiology, 3 involved a failure of the teleradiologist to describe an important chronic condition that was known to patients and providers at the time the image was obtained. In one case, the teleradiologist failed to comment on a deep right buttock infection due to coccidiomycosis. In a second case, the teleradiologist failed to describe chronic bilateral hip osteomyelitis. In the third case, the teleradiologist failed to identify a small, non-obstructive renal calculus that had been identified on a prior CT scan. This patient was admitted due to abdominal pain, which, based on physician documentation, seems to have been unrelated to his renal calculus. His care likely would not have changed if the teleradiologist had described the presence of a renal calculus.

Only one of the major discrepancies classified as an under-read by teleradiology resulted in an adverse event. In this case, the teleradiologist failed to identify intussusception seen on the film the following day by the in-house radiologist. The treating Emergency Physician was concerned about the diagnosis partly because a previous CT scan had suggested it. The physician spoke by phone with the teleradiologist, was told the patient probably had a polyp but did not have intussusception, and discharged the patient. The next day the CT scan was read by the in-house radiologist as showing a high-grade

Table 1. Major Discrepancies between Teleradiology and In-house Radiology

CT Scan	Teleradiology Interpretation	In-house Radiology Interpretation	Diagnosis	Classification
Head	Porencephalic cyst under pressure displacing posterior angle of left frontal horn*‡	Encephalomalacia	Seizures, discharged next day	Over-read by teleradiology
	Negative	Frontal and right parietal contusions	Crush injury to left leg, discharged 6 days later	Over-read by in-house radiology
	Negative	Left parietal hemorrhage	Forehead laceration, discharged next day	Unclear
	Chronic ischemic changes, no hemorrhage	Brainstem hemorrhage	Carbamazepine overdose, discharged 4 days later	Over-read by in-house radiology
	Scalp swelling	Right temporal contusion, falx subdural	Open scalp wound, discharged same day	Over-read by in-house radiology
	Negative	Left parietal hemorrhage	Seizures, discharged same day	Over-read by in-house radiology
	Negative	Right temperoparietal hemorrhage	Concussion vs. closed head injury, discharged next day	Over-read by in-house radiology
C-Spine	Negative	Atlanto-axial widening	Cervical strain, discharged same day	Over-read by in-house radiology
Chest	Small pulmonary embolism, right pleural fluid*‡	No pulmonary embolism, tiny right effusion	Lupus, urinary infection, discharged next day	Over-read by teleradiology
	Pulmonary embolism, small pericardial effusion	No pulmonary embolism	Chest pain, unclear etiology, discharged next day	Unclear
	Bilateral pneumothoraces‡	Right pneumothorax with extension of subcutaneous air to left chest, no left pneumothorax	Right pneumothorax, transferred next day	Over-read by teleradiology
Abdomen and Pelvis	No evidence of intraperitoneal injury from stab wound	Minimal capsular or subcapsular fluid anterior to right lobe of liver	Stab wound to the abdomen, discharged next day	Unclear
	Left inferior ramus fracture, occlusion of left femoral artery	Left inferior ramus fracture, no occlusion of left femoral artery	Left inferior rami fracture, previous left below knee amputation, discharged 5 days later	Unclear
	Acute pancreatitis, ascites	Ascites, inflamed proximal bowel loops	Acute pancreatitis, discharged 6 days later	Unclear
	Negative‡	2-mm calculus middle pole of right kidney, no hydronephrosis	Non-obstructive stone, discharged 3 days later	Under-read by teleradiology
	Colostomy, otherwise normal	Colostomy, small bowel obstruction vs. ileus	Vomiting, discharged same day	Unclear
	Appendicitis with surrounding fat induration.	Negative	Acute appendicitis	Under-read by in-house radiology
	Negative except small bowel polyp†‡	High grade small bowel obstruction, small bowel polyp	Discharged, returned 3 days later with intussusception	Under-read by teleradiology
	Free fluid in the cul-de-sac	Negative	Facial, chest contusions, discharged next day	Unclear
	Negative	Small bowel contusion	Rib fracture, discharged same day	Unclear
	Left pubic rami fracture, right sacral fracture	Negative	Transferred, lost to follow-up	Unclear
	Sigmoid colitis consistent with ischemic bowel‡	Negative	Gastroenteritis, discharged 4 days later	Over-read by teleradiology
	IVC filter, otherwise negative‡	IVC filter, bilateral hip osteomyelitis	Discharged same day, patient know to haved chronic bilateral hip osteomyelitis at time of discharge	Under-read by teleradiology
	High-grade small bowel obstruction	Mild small bowel dilatation, no obstruction	Constipation, discharged 5 days later	Unclear
	Negative	Small bowel contusion	Concussion, discharged same day	Unclear

Table 1. (Continued)

CT Scan	Teleradiology Interpretation	In-house Radiology Interpretation	Diagnosis	Classification
	Mild ileus	Sigmoid colitis	Celiac disease, discharged 41 days later	Unclear
	Adrenal hematoma, right superior rami fracture	Tiny left pneumothorax, right superior rami fracture	Right superior rami fracture, discharged 5 days later	Unclear regarding either adrenal hematoma or pneumothorax
	Small free fluid in cul-de-sac‡	Inflammatory changes in right buttock extending to gluteus	Disseminated coccidiomycosis, known to providers at time of discharge next day	Under-read by teleradiology
	Appendicitis with induration of surrounding fat	Negative	Acute appendicitis	Under-read by in-house radiology
	Negative	Grade 1 liver laceration, small bowel contusion	Rib fractures, pulmonary contusion, discharged 10 days later	Unclear
	Negative	Faint bilateral calcifications, no hydronephrosis	Abdominal pain, discharged same day	Unclear
	Free gas in gallbladder fossa, consider perforated ulcer	Mild dilatation of small bowel	Perforated duodenal ulcer	Under-read by in-house radiology

* Teleradiology misinterpretations that probably prompted an unnecessary hospital admission.
† Teleradiology misinterpretation that probably caused an adverse event.
‡ Discrepancies classified as misinterpretations by teleradiology.
CT = computed tomography; IVC = inferior vena cava.

small bowel obstruction and likely intussusception. Attempts to contact the patient were unsuccessful. The patient returned to the ED with recurrent abdominal pain 3 days later, was diagnosed with intussusception, and had a small bowel resection the same day. At follow-up 2 years after the operation, the patient was well and without abdominal or gastrointestinal complaints.

Of the 32 cases in which a major discrepancy was identified, there were 3 cases in which follow-up information could not be obtained. Of the 29 cases for which we obtained follow-up information, we found only one case in which an adverse patient event could be attributed to the discrepancy. This was the case of intussusception previously described.

Of the 64 chest CT scans obtained during the 3-month period, 17 were for the evaluation of trauma patients and 47 for the evaluation of patients with non-traumatic conditions. Thirty-one of these 47 studies were CT pulmonary angiogram studies to evaluate for pulmonary embolism. Although pathology was found on many of these CT pulmonary angiograms, only two were read as positive by teleradiology for pulmonary embolism. Both of these studies were subsequently re-interpreted as negative for pulmonary embolism on the following day. On review of clinical information for these two major discrepancies, one discrepancy was classified as an over-read by teleradiology. We were unable to classify the other discrepancy based on clinical data, as the patient had symptoms consistent with pulmonary embolism and was already on medication for deep venous thrombosis. Both patients were alive and well at 2-year follow-up, and neither had subsequently been diagnosed with a pulmonary embolism.

DISCUSSION

Our study identified major discrepancies between teleradiologist and in-house radiologist interpretations for approximately 6% of commonly ordered CT scans. Major discrepancies occurred at similar frequencies for the four types of CT scans we studied. Of the discrepancies we attributed to teleradiology misinterpretation, there were similar numbers of over-reads and under-reads. On review of the management of patients for whom a major discrepancy was identified, only one patient suffered an adverse event that could be attributed to the discrepancy in image interpretation.

In our study, certain types of pathology commonly resulted in a major discrepancy in CT interpretation. These include intraparenchymal cerebral contusion or hemorrhage (6 cases), pulmonary embolism (2 cases), small bowel pathology (5 cases), and renal calculi (2 cases). Although the study was not designed to specifi-

cally identify types of pathology for which discrepancies are more likely to occur, it is possible that the high frequencies of discrepancies associated with these types of pathology occurred because the radiographic findings for these illnesses are sometimes subtle. Fortunately, with the exception of pulmonary embolism, these types of pathology are typically managed clinically; a patient with a small renal calculus or a subtle intraparenchymal cerebral hemorrhage who looks well will probably not suffer an adverse event if discharged without identification of this pathology. Pulmonary embolism is an important exception to this generalization.

Before conducting the study, we had speculated that teleradiologists tend to over-read CT scans, and we anticipated that teleradiology interpretations were leading to numerous inappropriate admissions. Only two of the 550 pairs of CT scans involved had a major discrepancy leading to inappropriate admission. The number of over-reads by in-house radiology and teleradiology were similar (6 vs. 4 cases), as was the total number of misinterpretations (9 vs. 8). These findings suggest that the discrepancies between in-house radiology and teleradiology we identified reflect discrepancies that would occur between any two radiologists reading films.

LIMITATIONS

This study has several limitations. We compare a single teleradiology group and a single in-house radiology group providing interpretations to Emergency Medicine residents working with attending physicians. We do not know if our findings are representative of other teleradiology and in-house radiology groups. Our in-house radiologists had access to and typically reviewed teleradiology interpretations before making their own interpretation. For this reason, this study is not a head-to-head comparison of two radiology groups, but instead attempts to determine how often an Emergency Physician would get a teleradiology interpretation that is significantly different from the "official" next day interpretation. Because in-house radiologists were not blinded to the teleradiologist interpretation, it is possible that they were biased towards agreeing with the teleradiologist interpretation. This arrangement may lead to cases in which both the teleradiologist and the in-house radiologist missed important findings; misses by both radiologists would not be identified using our methods. Images in our study were acquired using a 4-slice CT scanner. Newer CT scanners are widely used and provide more detailed images; the effect of these more detailed images on discrepancy frequencies between radiologists and on ED decision-making is unknown. Clinicians could discuss the preliminary findings with the teleradiologist by telephone. It is possible that in some cases, the clinician, who had access to more detailed clinical information, pointed out abnormalities to the teleradiologist that were not initially identified by the teleradiologist. If this occurred, an amended report could be submitted in place of the original, without reference to the original or to the discussion with the clinician. We were unable to determine whether this occurred during the study period. If the teleradiology interpretations we studied included such amendments, it would cause us to underestimate the rate of discrepancies in a setting where communication between clinicians and teleradiologists did not occur.

We used all available medical records including discharge summaries, clinic follow-up, and additional imaging studies to classify major discrepancies as either over-reads or under-reads by teleradiology or in-house radiology. For 15 of the 32 major discrepancies, we could not classify the discrepancy. For example, a patient who has a traumatic head injury and is discharged the next day with a head CT scan read as negative by teleradiology and read as positive for a small parietal hemorrhage by in-house radiology, may or may not have actually had a parietal hemorrhage. The outcome is consistent with either image interpretation. Even in cases in which we did classify the discrepancy as an over-read or under-read by in-house radiology, it is possible that our classification was wrong. We chose follow-up information as the criteria on which to classify discrepancies as over-reads or under-reads rather than further review by independent radiologists. When clinical information revealed a diagnosis, such as an operative report finding of appendicitis, we treated image interpretations describing this diagnosis as correct. However, this method is not foolproof.

CONCLUSIONS

Major discrepancies in interpretations by teleradiologists and in-house radiologists occurred for approximately 6% of CT scans. Misinterpretations by teleradiologists and in-house radiologists occurred at a similar frequency. A major discrepancy led to an adverse event for only one of 550 pairs of interpretations. Our findings suggest that discrepant interpretations may be more common for certain types of pathology (intraparenchymal cerebral changes, small bowel pathology, renal calculi, and pulmonary emboli). Our findings support the cautious use of teleradiology interpretations for ED decision-making. Further study is needed to better define the sensitivity of teleradiology interpretations for identifying significant pathology, the types of pathology for which major discrepancies occur, and the types of management errors

that patients are exposed to from such discrepancies, with the goal of assisting Emergency Physicians in using teleradiology interpretations to make appropriate medical decisions.

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