Incidental Extra Spinal Findings at CT Lumbar Spine on Wide Field of View Reconstructions

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Abstract

Purpose: To determine the incidence and importance of extra spinal findings at CT lumbar spine to determine if wide field of view soft tissue window reconstructions should be routinely provided for reporting.

Methods: CT lumbar spine examinations performed in a private radiology practice between 10/2/2011 and 1/12/2011 routinely had wide field of view reconstructions of the abdomen provided and stored on the picture archiving and communication system (PACS). These reconstructions were retrospectively reviewed to identify extraspinal pathologies that were then classified as of minor or major importance. This was correlated with demographic data.

Results: 355 studies fulfilled inclusion criteria, 42.8% being performed in males. 46% of patients had an incidental extraspinal finding and these patients were older, 64 years versus 49 years compared with patients with no incidental finding. Males were more likely to have an incidental finding. 16 of 355 studies (4%) found a major incidental finding.

Conclusion: Incidental extraspinal findings are common, are typically minor and can be confidently diagnosed on the source data with little need for further investigation. Given the benefit of identifying major findings, wide field of view reconstructions should be routinely provided for reporting.

Keywords
Lumbar spine; Computed tomographic; Colonography reporting; Data system

Introduction

Computed tomographic (CT) imaging of the lumbar spine is frequently performed to evaluate patients with lumbar back pain or radicular symptoms. The images for reporting are commonly magnified around the lumbar spine cropping out much of the intra abdominal and retroperitoneal structures. While this provides optimal delineation of spinal pathologies, it potentially results in the exclusion of important extraspinal pathologies from the final dataset. Given the simplicity of providing wide field of view reconstructions that encompass these structures, we have examined the incidence and type of extraspinal incidental findings revealed by wide field of view review.

The detection of incidental findings at imaging is well known [1-8]. Some authors argue that these findings provide additional benefit to patients; while others feel that they result in increased patient anxiety, further investigation and further expense. Incidental findings have mainly been examined in the setting of cardiac CT, CT colonography (CTC) and in modern nuclear medicine where non-contrast CT is frequently obtained for co-registration. The incidence and type of incidental findings at CT lumbar spine has only been investigated by a single study [9] and so there is no consensus whether wide field of view reconstructions should be routinely provided to radiologists for reporting. Our study has examined the incidence and importance of extra spinal findings at CT lumbar spine to determine if wide field of view soft tissue window reconstructions should be routinely provided for reporting.

Method

The study was performed in a private radiology practice situated within a private hospital and servicing specialist referrals for both inpatients and outpatients, while also providing services for local general practitioners. Inclusion criteria were all CT lumbar spine examinations performed between 1 February 2011 and 1 December 2011. Postoperative studies targeted on metal position were excluded as they are highly targeted studies and prone to metallic artifacts. The institutional ethics review board granted approval and due to the retrospective nature of the study waived informed consent.

The CT scans were performed on either a 64 slice Siemens Somatom Sensation or 6 slice Siemens Somatom Emotion scanner with typical scan parameters on the 64 slice of kV 120, modulated mAs, pitch 0.55, and on the 6 slice of kV 130, modulated mAs and pitch 0.6. Both scans had wide field of view axial reconstructions with soft tissue kernel as 5mm thick contiguous slices sent to and stored on PACS.

Our practices standard CT lumbar spine protocol includes wide field of view soft tissue kernel reconstructions of the entire scan plan (usually mid T12 to mid S1 vertebral levels). All studies were retrospectively reviewed by one of two radiologist investigators (TS and NS) to detect and categorize all non-spinal findings while also extracting demographic and referral source data. There is always a degree of subjectivity when categorizing findings as ‘significant’ or ‘insignificant’. For this reason a widely used and well defined system was applied, being the CT Colonography Reporting and Data System (CRADS) [10]. This system was selected as it has been used in prior research studies examining incidental intra-abdominal findings, is simple to use and is relatively reproducible. This system comprises 5 grades; E0 artifact limits evaluation; E1 normal exam or anatomical variant; E2 clinically unimportant finding; E3 likely unimportant finding incompletely characterized; E4 potentially important finding. Although the majority of E3 and E4 findings are benign, our study classified E3 and E4 as major findings as these frequently lead to further investigation, increased costs and patient anxiety. Statistical analysis involved the use of a two sided student t test and Fisher exact test where appropriate.
Results

Between 1 February 2011 and 1 December 2011 a total of 358 studies were performed. 3 studies were excluded, as wide field of view reconstruction was not performed. Of the 355 remaining studies 152 (42.8%) were performed in males (average age 56.7 years) and 203 (57.2%) in females (average age 55.1 years). 275 (77.5%) studies were referred by general practitioners (GPs) and 80 (22.5%) were referred from specialists. Patients from specialists were older than from GPs, 66 years versus 53 years respectively.

162 of 355 (46%) patients had an incidental extraspinal finding with an average age of 64 years compared to the 193 (54%) of patients with no finding and average age of 49 years. This was statistically significant (p = 0.00009). 82 of 203 (40%) of females had a finding with an average age 61 years and 80 of 152 (53%) of males had a finding with average age of 67 years. The difference in incidence of findings between genders was statistically significant with Fishers exact test (p = 0.006).

Major findings occurred in 16 of 355 (4%). 5 were in females (2% of females had a major finding) and 11 in males (7% of males had a major finding). The incidence between genders was statistically significant (p = 0.002). The average age of patients with a major finding was 70.5 years (range 27-83) with no statistical difference between gender ages. This compares with an average age of 54.8 years with no major finding (p < 0.05).

No patient was recorded as E0, one patient had E1 findings, 145 had E2, 1 had E3 and 15 had E4 findings. Examples of E1 to E4 findings are presented in figure 1. The one patient with E3 findings had a homogenously hyperdense renal cyst. 11 of the 15 E4 pathologies were vascular aneurysms (9 abdominal aortic aneurysms and 2 splenic aneurysms), one was a solid pelvic mass (superior aspect seen only), and a single case each of lymphadenopathy, splenomegaly and an aggressive appearing iliac crest lesion.

Discussion

The detection of incidental findings beyond the region of interest is well known and has been explored for a number of imaging examinations. While initially sounding beneficial, the cost benefit consequences of these findings are debated by different investigators.

A potential benefit of diagnosing incidental extraspinal findings is the identification of important pathologies at a stage when they can be treated most effectively. For example vascular aneurysms can be identified before potentially presenting with rupture and tumours can potentially be identified at an earlier stage. However the wide field of view reconstructions are suboptimal from an abdominal imaging viewpoint as they are performed without oral or intravenous contrast agents, and are potentially more prone to respiratory motion artifact. This makes accurate characterisation of pathologies more challenging and so further investigation may be required. It is difficult to quantify the anxiety that further investigation causes for patients, and the potential risks they are exposed to by more invasive investigations. The cost to the health budget of these additional investigations must also be considered, although again it is exceedingly difficult to estimate.

In the setting of CT colonography for example the additional cost for investigation of extra colonic findings has been estimated to be up to 153 pounds [11] which is more than the cost of the CTC study.

Our study is reassuring in that although incidental findings are common being detected in 46% of patients most can be confidently diagnosed on the non-contrast images. Only a small minority of patients had an ‘indeterminate lesion’ that warranted further investigation. The rate of indeterminate lesions is less than for extracolonic findings at CTC [3]. This may be due to diagnostic uncertainty related to reduce soft tissue contrast at CTC as these are performed using low radiation dose techniques.

Our incidence of 46% for incidental findings correlates well with the 40.5% reported in a recent study by Lee et al. [9]. The main

![Figure 1: A) Low density adrenal lesion in keeping with an adenoma. Classified as E2. B) Sclerotic lesion in the right iliac crest (arrow) classified as E4. C) Peripherally calcified splenic artery aneurysm (arrow) classified as E4. D) Fluid attenuation renal cyst (arrow) confidently classified as E2. E) A horseshoe kidney classified as E1.](image-url)
difference between these two studies is the rate of E3 classifications being less than 1% in our study but 10.5% in Lee’s group. Part of this can be explained by the subjective nature of categorizing the importance of lesions, despite guidance by systems such as CRADS. For example, Lee classed ectatic abdominal aorta 2.6-2.9cm as E3 while we classified it E2. The splenomegaly, pelvic mass and iliac crest lesion that we classified as E4, had similar pathologies classified as E3 in the Lee study. These differences will likely be reproduced between individual radiology practices and different radiologists, as the classification can be subjective and influenced by previous experience. However both studies have demonstrated that only a small proportion of patients require further investigation.

A limitation of our study is that we are unable to determine which incidental findings were preexisting and known versus those that are a new diagnosis. From a diagnostic point of view this is only a small limitation as the referring doctor should be able to differentiate these. However it is more significant if our results are to be used to estimate the additional costs incurred by reporting these findings, which will be overestimated by including both new and preexisting conditions. Cost estimates are difficult to make as it has been shown that referring doctors instigate further investigation even when the reporting radiologist does not suggest it or think it is required [12,13].

Our study identified increasing age and male gender as risk factors for incidental findings. Studies of extracolonic findings at CTC have also found that increasing age is a risk factor, but frequently have more incidental findings in females. This difference is most likely due to scans finishing at around the S1 vertebral body level and so female gynaecological organs are not included in the scan plane. Ovarian and uterine findings are frequent at CTC.

Conclusion

The small proportion of findings classified as E3 and E4 is reassuring as it shows that further imaging and therefore expense is only infrequently required for benign lesions. The potential benefit of identifying major pathologies is substantial, and given that wide field of view reconstructions can be generated from the original data set with no additional radiation to the patient, these should be routinely provided for review.

References


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