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Thoracic CT in the ED: a study of thoracic computed tomography utilisation.

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Thoracic CT in the ED: A Study of Thoracic Computed Tomography Utilisation

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Abstract

The aim of this retrospective study was to investigate the use of thoracic Computed Tomography (CT) in the Emergency Department of a Dublin Academic Teaching Hospital over a six month period. Data was retrieved using the hospital's computerised information system. There were 202 referrals in total for thoracic CT from the Emergency Department during this time period. The most common indication for thoracic CT referral was for the investigation of pulmonary embolism with 127 (63%) referrals. There were 40 (25%) referrals for suspected malignancy and lung disease, whilst 8 (4%) of the referrals were for investigation of thoracic aortic dissection, 8 (4%) for infection, and 6 (3%) were for investigation of thoracic injury. Only 8 (4%) of all referrals were for investigation of injury as a result of chest trauma.

Introduction

Thoracic Computed Tomography (CT) has become an established and invaluable imaging modality to evaluate medical emergencies and trauma patients attending Emergency Departments.[1,2] It has become the investigation of choice in emergency medicine in detecting and outruling some potentially fatal conditions particularly blunt aortic injury[3,4] and pulmonary embolism.[1,5] However, despite it's efficacy in detecting abnormalities, the use of thoracic CT imposes an increased financial cost to the service provider and increased radiation exposure to the patient particularly to breast and lung tissue.[5,6] CT scans requiring the use of contrast media such as CT pulmonary angiography are also associated with contrast induced nephropathy particularly in patients with reduced renal function and patients with diabetes.[7] The aim of this retrospective study was to assess the extent of utilisation of thoracic CT as an investigation modality in emergency medicine practice in the Emergency Department of a Dublin Academic Teaching Hospital (DATH) over a six month period.

Methods

The Emergency Department in Beaumont Hospital provides care to 46,000 patients per year while serving a catchment population of 250,000 people. It has access to two Siemens multislice CT scanners (6 and 16 slice). All patients who attended the Emergency Department in Beaumont Hospital between January and June of 2008, who were referred for a Thoracic CT scan including a Computed Tomography Pulmonary Angiography (CTPA) scan were selected for inclusion in this study. The number of thoracic CT scans performed within the hospital over this time period were retrieved from the hospital departmental referral database. Those referred from the Emergency Department were isolated and then individually reviewed using the Beaumont Hospital Information System. The information obtained included the reason for thoracic CT referral and the result of the scan. Where trauma was noted as an indication for referral, further information regarding the type of trauma and initial X-ray results were obtained from the Emergency Department scanned computer records. Indications for referral were coded into eight different categories. The number of positive scans that confirmed the queried diagnosis was recorded, as were scans that were deemed non-diagnostic. The information was collated using Microsoft Excel and analysed using descriptive statistics.

Results

From January to June of 2008 there were 202 thoracic CT referrals from the Emergency Department of Beaumont Hospital. Table 1 is a summary of indications for thoracic CT scan referral from the Emergency Department.

Table 1: Indication for Thoracic CT scan in the ED

Indication for Referral	Number (% of total)	Male	Female
Pulmonary Embolism	127 (63%)	44	83
Malignancy	39 (19%)	19	20
Lung Disease	11 (5.5%)	6	5
Thoracic Aortic Dissection	8 (4%)	4	4
Infection	8 (4%)	3	5
Thoracic Injury	6 (3%)	6	0
Air Leak Syndrome	2 (1%)	2	0
Oesophageal stricture	1 (.5%)	0	1
Total	**202**	**84**	**118**

Table 2 is a summary of the number of thoracic CT scans that confirmed or suggested a diagnosis and the number deemed non-diagnostic. Eight (4%) of all Thoracic CT referrals were due to suspected injuries as a result of trauma, 2 of which were for suspected thoracic aortic dissection and 6 were for a suspected thoracic injury. No thoracic aortic dissections were diagnosed. Two thoracic injuries were diagnosed and included a pneumothorax and a splenic laceration respectively. A fall was the most common cause of trauma (50%). Other causes of trauma included a stab wound, a gunshot wound, a road traffic accident and a kick by a horse. All those referred for thoracic CT as a result of trauma were male.

Table 2: Number of confirmed/suggested diagnosis and non-diagnostic Results

Indication for referral	Number	Confirmed/ suggested diagnosis	Non-diagnostic result
Pulmonary Embolism	127	23 (18%)	4 (3%)
Malignancy	39	15 (38%)	6 (15%)
Lung Disease	11	6 (54%)	0 (0%)
Thoracic Aortic Dissection	8	0 (0%)	0 (0%)
Infection	8	6 (75%)	0 (0%)
Thoracic Injury	6	2 (33%)	0 (0%)
Air Leak Syndrome	2	0 (0%)	0 (0%)
Oesophageal stricture	1	1 (100%)	0 (0%)
Total	**202**	**53**	**10**

Discussion

The ability of thoracic CT, specifically CT pulmonary angiography (CTPA), to detect additional findings or indicate an alternative diagnosis has increased its value particularly in the Emergency Department, and has largely replaced ventilation/perfusion scanning in the diagnosis of pulmonary emboli.[8] In this study 63% of all referrals for thoracic CT were for this reason, of which 18% had emboli confirmed. This is in keeping with current literature that cites the range of positive findings for pulmonary embolism to be between 12 and 35%.[9] Caution must remain, however, in comparing such values, as the aim of this study was not specifically looking at the rate of diagnosis of pulmonary embolism. A recent study investigating the frequency of thoracic CT referrals in North America suggests that the use of thoracic CT for the detection of pulmonary emboli in the emergency department has dramatically increased in recent years and, at a greater rate compared to its use for hospitalised patients. Despite this increase, the authors found that the rate of actual positive results had not increased and suggested that thoracic CT is being used as a screening tool rather than an investigation of confirmation following other diagnostic tests. They caution the use of CTPA as a first line screening tool and emphasised radiation exposure as a concern. They also highlight the fact that due to the sensitivity of CTPA, the detection of small sub segmental emboli has increased and, as a result patients may be prescribed anti-coagulation therapy unnecessarily.[8]

In this study, the use of thoracic CT for the detection of acute aortic dissection was 4% of all referrals. Despite no positive findings, the literature regarding acute aortic dissection would suggest that the use of thoracic CT to rule out this condition is warranted, given that clinical examination may not reveal signs of injury, and interpretation of the chest X-ray can be difficult.[10]As such, O' Conor in 2004 recommended that the emergency physician should maintain a high index of suspicion for aortic injury, and that a low threshold for deciding whether to refer for thoracic CT should remain despite the large number of negative results.[10] Other medical indications for thoracic CT referral included suspected malignancy and lung disease. These conditions are not necessarily considered medical emergencies per se and yet in combination account for approximately 25% of all thoracic CT referrals from the Emergency Department. Lung disease and malignancy are not typically investigated from the Emergency Department and very little research exists in relation to thoracic CT for these conditions in the context of emergency medicine. A possible reason for such a large proportion of medical non-emergency thoracic CT referrals occurring in this study maybe due to patients presenting to the emergency department with respiratory complications as a result of an underlying undiagnosed condition requiring further investigation such as thoracic CT scanning. Another reason is perhaps due to prolonged patient stays in the Emergency Department whilst awaiting an in-patient bed and referral to the relevant services following the respiratory or malignancy work-up by the admitting team.

Surprisingly, trauma accounted for only 4% of all thoracic CT referrals. It is possible that the reason for this low number was because few incidences of chest trauma took place during this time period. Though this is possible, it is unlikely given the high level of throughput in this Emergency Department. A more likely explanation is that the emergency physicians in the department were satisfied with chest X-ray findings to rule out injury and only referred to CT when a high index of clinical suspicion remained. It is interesting to note that all those referred for thoracic CT as a result of trauma were male and a fall was the most common mechanism of injury. This is an unsurprising finding given that men are twice as likely to die as a result of an accident and more likely to be admitted to hospital with accidental injury than women.[11]

The issue of whether thoracic CT should be routinely included in the initial assessment of patients who sustain chest trauma is controversial.[12] Currently, a chest X-ray is part of the standard procedure used in the Emergency Department where chest trauma is suspected. However, according to Trupka et al, significant injuries such as pneumothoraces, haemothoraces, lung contusions and blunt aortic injuries can be readily missed by this screening method alone. These authors carried out a prospective study on the value of CT in the first assessment of patients with blunt chest trauma and found thoracic CT to be superior in detecting injuries compared to chest X-ray. They stated that early thoracic CT had a significant influence and impact on patient management thereby reducing complications and increasing outcome survival.[4] In contrast to this finding, Traub et al cite references suggesting thoracic CT to have no major impact on management of blunt trauma and query the overuse and over dependency on CT results in such instances.[13] Similarly, Plurad et al in 2007 questioned the over utilisation of CT in chest trauma, stating that referral for thoracic CT on the basis of mechanism of injury, despite no physical findings and a negative chest X-ray had become common place. They highlight the monetary cost and exposure to radiation for the patient and question if there is sufficient benefit to this method of screening.[6]

The use of thoracic CT in the Emergency Department is undoubtedly set to rise in the future. CT is increasingly being used in the diagnosis of coronary artery disease as a non-invasive alternative to cardiac catheterisation, and some studies suggest that it is set to become part of the standard work up of Emergency Department patients presenting with acute chest pain.[14,15] As more advanced CT technology becomes available, newer scans like the triple rule out scan, which provides the ability to investigate myocardial infarction, pulmonary embolism and aortic dissection at one time,[1] will be increasingly utilised to out rule multiple causes of chest pain that

regularly present to the Emergency Department.[16] Computed Tomography Coronary Angiography (CTCA) and triple rule out scans are increasingly being used in the United States. In a very recent survey of radiology departments servicing Emergency Departments, it was estimated that 33% used CTCA in the work up of chest pain and 18% used the triple rule-out scan to rule out coronary artery disease, pulmonary embolism and aortic dissection in emergency patients.[1] However, despite apparent efficacy, further studies are needed to corroborate their use in clinical practice. As with other uses of CT, caution in relation to radiation exposure, contrast induced nephropathy and cost to the service user must be considered.

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