Objective: Thoracoabdominal computed tomography is a rapid and effective diagnostic procedure for evaluating internal structures after traumatic injury. (ref needed: scan/year BIBA trauma) However, there is considerable discussion on whether or not this diagnostic tool is overused. CT scans deliver significant doses of ionizing radiation, increasing risk of radiation damage and cancer in some patient populations. Furthermore, CTs may discover findings of unclear significance, prompting hospital admission and/or costly evaluation.

While CT scans are necessary for certain types of trauma, questions remain on the best criteria upon which to base the decision to order a CT. In the population of patients who are hemodynamically stable upon admission, decisions to order a scan may be based on the mechanism of injury, physical exam findings, Injury Severity Score (ISS), the presence of “distracting” injuries or factors suggesting potentially serious pathology, or a spectrum of abnormal findings that suggest an uncertain pathophysiological process. Regardless of how the decision to order a trauma CT is reached, the goal should be detection of the greatest number of urgent or emergent medical conditions.

In June of 2010, BMC implemented a new trauma CT protocol whereby CT scans were reserved for patients who presented with abnormal physical exam findings or injuries/mental status changes suggesting or confounding potentially serious disease processes. We hypothesized that the new protocol decreasing CT usage would decrease the total number of scans performed while increasing the detection rate for urgent and emergent conditions.

Methods: Data was collected retrospectively from the BMC trauma registry. Dates of data collection were July 1st through September 30th of 2009 and 2010. All patients arriving in the BMC Emergency Department who received a CT scan of the head, neck, chest, abdomen/pelvis (pan-scan) were included. Patients were classified as presenting with a “distracting injury/state” or not. All distracting state injuries mandated a CT scan.

Emergency Department reports were searched to determine if:
1. The patient was intubated in the ED.
2. Physical exam of the head, neck, chest, or abdomen/pelvis (pan-scan) were included. Patients were classified as presenting with a “distracting injury/state” or not. All distracting state injuries mandated a CT scan.
3. The patient presented with “distracting injuries”, defined as any injury classified as “important” (Table 3), or a positive alcohol/tox screen, or a GCS < 13.
4. The patient was admitted, and the level of acuity of admission.

CT scans of the head, neck, chest, abdomen/pelvis were analyzed to identify radiologically significant injuries. These were classified as “important”, “trivial”, or “serendipitous” (Table 2) based on the necessity to admit, and the presence of the finding on previous studies. Total number of CTs performed on each patient and the number of repeated studies were documented.

Results from 2009 and 2010 were compared statistically using paired two-tailed t-tests. Metrics compared were rate of 1) negative scans, 2) important injury discovery, 3) trivial injury discovery, 4) serendipitous finding discovery, and scans for individuals presenting with distracting states.

Results:

Discussion:

From the data, the significant increase in positive findings (Figure 1, p = 4*10^-7) strengthens the rationale for selective scanning based on physical exam findings. This was as we expected for thorax and abdomen/pelvis trauma, since sensitive and specific tests exist for evaluating the state of the region contents in both the urgent and emergent setting. Thus, CTs can be ordered selectively with a high threshold of clinical suspicion. This is in contrast to head injuries, which may progress insidiously, necessitating a low degree of suspicion with potentially no physical findings to order a CT or other imaging study. The observed correlation may be stronger if patients with mental status (MS) changes are removed from the analysis, but more recent data is needed to provide sufficient power.

Furthermore, it is apparent that the new CT pan-scan protocol decreases the number of patients who receive trauma CTs, and reduces the total number of CTs per patient. This is presumably due to the limitation of CTs to regions with physical findings since the physical exam maneuvers are sensitive and specific for gross changes in the thorax and abdomen. A large pan-scan presented with MS changes (Table 4), and received a full pan-scan (4 CTs: Head/Neck, Thorax, Abdomen, Pelvis). Subsequent analysis with these individuals removed may show a further significant decrease in the number of CTs performed.

There is a significant difference between the two data sets with respect to ISS (Table 2), which is likely due to increased scanning efficacy; more scans for truly injured patients and fewer scans for those with no injuries. The true strength of this association is difficult to measure, as we cannot determine if the algorithm causes us to miss injuries without scanning patients we did not intend to scan.

The classification of injuries identified (Figure 2) does not show a significant difference between the scanning protocols, illustrating that the new CT protocol only affects the decision to perform a CT scan and the regions to be scanned. This is as expected since physical exam findings are only useful for identifying the presence of an injury, not classifying the severity.

Conclusions:

1) Using protocols based on physical exam findings in the thorax and abdomen/pelvis, the total number of CTs pan-scans performed in the setting of trauma is reduced significantly compared to protocols based on mechanism of injury, ISS, and GCS.

2) CT protocols based on physical exam findings in the thorax and abdomen/pelvis are significantly more likely to discover radiologically important injuries than other scanning protocols.

3) Protocols based on physical exam findings do not differ significantly with other protocols in regards to the types of injuries detected, indicating that the new exam finding is only sensitive to the presence of injury, and not the severity.

References:


