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Pan-body computed tomographic scanning for patients with intracranial hemorrhage after low-energy falls

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Abstract

BACKGROUND: We sought to determine if a liberal policy of pan-body computerized tomography (CT) scanning was useful in patients with intracranial hemorrhage after low falls.

METHODS: Patients with intracranial hemorrhage after low falls, with a Glasgow Coma Score of greater than or equal to 14 and systolic blood pressure of greater than 100 mm Hg, were included. The primary outcome was any torso or spine injury requiring surgical or radiologic intervention. The secondary outcome was any torso or spine injury.

RESULTS: Of 365 patients, 71% underwent pan-body CT. Eight (2%) patients had a primary outcome and 66 (18%) a secondary outcome. Only signs and symptoms of cervical injury were associated with a cervical-related outcome (4/23 vs 3/316, $P = .005$). Only signs and symptoms of torso injury were associated with a torso-related outcome.

CONCLUSIONS: A liberal policy of pan-body CT in these patients is of low yield. Signs and symptoms of trauma should dictate the judicious use of CT.

Since its public inception in 1972, computerized tomography (CT) has gained tremendous popularity in the evaluation of trauma patients in the emergency department (ED) because of technological advances. Several authors have advocated the liberal or routine use of pan-body CT scanning for patients with a significant mechanism of injury as a rapid, cost-effective way to evaluate and triage trauma patients. Although this approach might be useful in patients with high-energy mechanisms of injury, it is unclear if such a policy would be beneficial in patients with low-energy mechanisms of injury. Our standard practice is to admit all patients with acute intracranial hemorrhage to the intensive care unit initially for serial evaluations. We sought to determine if a liberal policy of pan-body CT scanning would be useful in these patients, who, by definition, would receive frequent repeated inpatient clinical assessments. Our hypothesis was that in this cohort, a liberal policy of pan-body CT scanning is of low yield.

Methods

The hospital Institutional Review Board approved the study with waiver of consent. A 5-year retrospective study

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(January 2009 to June 2013) was conducted in a level 2 trauma center. Patients aged greater than or equal to 13 years admitted after low-energy falls (defined as ≤3 ft or 5 stair steps) with acute traumatic intracranial hemorrhage seen on CT were screened. The inclusion criteria were the following: Glasgow Coma Score (GCS) of greater than or equal to 14 and following commands, admission systolic blood pressure (SBP) of greater than 100 mm Hg, and a normal Focused Assessment with Sonography in Trauma (FAST) examination. Pan-body CT scanning was defined as CTs of the brain, CT of the cervical spine (CTCS), and CT of the chest, abdomen, and pelvis (CTCAP) with formatted reconstructions of the thoracolumbar spine. A patient was considered to have undergone pan-body CT scanning only when all the above-mentioned CTs were performed on admission.

To assess the usefulness of pan-body CT scanning in this cohort, we defined 2 outcomes: the primary outcome was defined as any torso or spine injury excluding hip fractures that required surgical or invasive radiologic intervention. Therefore, craniofacial or extremity procedures were excluded using this definition. The secondary outcome was any torso or spine injury excluding hip fractures that did not require the above-mentioned interventions. We excluded hip fractures as a CT is usually not required for diagnosis.

Patients who received pan-body CT scanning were compared with those who did not with respect to the following plausible variables: SBP, presence of blood alcohol (any detectable level versus absent or not tested), antiplatelet agent use, anticoagulant use, signs and symptoms suggesting neck trauma, signs and symptoms suggesting torso or thoracolumbar spine trauma, GCS (score of 14 vs 15), tachycardia (heart rate >100/minute), thrombocytopenia (platelet count $<10^5/mm^3$), and the type of physician who ordered the CTs (trauma surgeon versus emergency medicine physician).

The above-mentioned variables were also assessed for their association with primary and secondary outcomes.

The components of the pan-body CT were separated to assess the yields of CTCS and CTCAP respectively in the detection of primary and secondary outcomes. To evaluate the yield of CTCS, only cervical-related outcomes were analyzed. To evaluate the yield of CTCAP, only torso-related outcomes were analyzed.

Proportions were expressed in exact 95% confidence limits where appropriate. Categorical variables were assessed using the chi-square test or Fisher's exact test where appropriate. Otherwise, the *t*-test or Mann–Whitney *U* test was used to analyze continuous variables. A *P* value of .05 indicated statistical significance.

We proposed that if the proportion of patients with a primary outcome detected on CT was less than or equal to 5%, then a liberal policy of pan-body CT scanning would not be useful in this cohort. Using calculations for a single proportion and assuming that the primary outcome occurred in 5% of patients with a margin of error of ±5% and a 95% confidence interval (CI), at least 143 patients would be required for the study. Minitab 16.2.4 (www.minitab.com/support) was used for statistical analysis.

Results

Three hundred and sixty-five patients met the above criteria and formed the study cohort. The mean age was 73 ± 18 years, and 76.5% of the sample was 65 years and older, indicating a predominantly elderly cohort. The median Injury Severity Score (ISS) was 16 (interquartile range 10 to 20). Fifteen (4%) patients underwent neurosurgical procedures related to the intracranial hemorrhage during the inpatient stay. On admission, 260 (71%) patients of this study cohort received pan-body CT scanning, while 105 did not. Of the 105 patients who did not receive pan-body CT scanning, 85 (23%) received either CTCS or CTCAP only and 20 (5%) did not receive any additional CTs other than the head CTs. In terms of body region, 341 (93%) patients underwent CTCS and 264 (72%) underwent CTCAP.

The characteristics of patients who received a pan-body CT on admission versus no pan-body CT are shown in Table 1. They were older, were more likely to be using antiplatelet agents or anticoagulants, and have signs and symptoms of torso trauma. A trauma surgeon was more likely to order a pan-body CT than an ED physician. The presence of alcohol, GCS of 14, SBP, median ISS, tachycardia, signs and symptoms of cervical trauma, and thrombocytopenia were not significant variables associated with the performance of a pan-body CT.

Of the entire cohort, 8 (2%; 95% CI .8% to 3.9%) patients had a primary outcome. The primary outcomes were hematoma of the pelvis or hip requiring angioembolization (n = 3), thoracolumbar spine fractures requiring percutaneous kyphoplasty (n = 2), cervical spine fractures requiring operative intervention (n = 2), and hemopneumothorax requiring tube thoracostomy (n = 1).

Sixty-six (18%; 95% CI 14% to 22%) patients had a secondary outcome, with rib fractures (10%) and thoracolumbar spine fractures (5%) being most commonly detected. The other secondary outcomes were pelvic and acetabular fractures (2%), gluteal or hip hematoma (1%), clavicle fractures (1%), cervical spine fractures (1%), retroperitoneal hemorrhage without organ or major vascular injury (.4%), chest wall hematoma (.2%), liver (.2%), renal (.2%), splenic (.2%), and pancreatic (.2%) injuries. All primary and secondary outcomes were detected at the time of admission.

The associations of both primary and secondary outcomes with pan-body CT scanning and the other plausible variables were examined. The occurrence of a primary outcome was associated with 2 variables, namely, signs and symptoms of cervical trauma (3/24 [13%] vs 5/341 [1%]) and antiplatelet agent use (8/206 [4%] vs 0/159 [0%], *P* = .01) only. Pan-body CT scanning was not a significant variable (8/260 [3%], 95% CI 1.4% to 6.1% vs 0/105 [0%],