Brief description of patient problem/setting: 93 year old female with advanced dementia and DNR/DNI status presented to the emergency department with acute altered mental status. The patient was unable to provide a reliable history; at baseline she intermittently responds with simple yes/no answers, but has had a recent cognitive and functional decline. There was no reported fall or head trauma. This raised the clinical question of whether obtaining a CT head would have meaningful diagnostic yield or change management in this patient population compared to a more selective or conservative imaging approach.

Search Question: In elderly patients with dementia presenting with acute altered mental status without a history of trauma, does routine CT head imaging compared to selective or no imaging improve diagnostic yield or result in a meaningful change in clinical management?

Question Type: What kind of question is this?
☐Prevalence ☐Screening ☐**Diagnosis** ☐Prognosis ☐Treatment ☐**Harms**

Assuming that the highest level of evidence to answer your question will be meta-analysis or systematic review, what other types of study might you include if these are not available (or if there is a much more current study of another type)? Please explain your choices.

If meta-analyses or systematic reviews are not available, I would include both prospective and retrospective cohort studies. These are useful because they look at real-world outcomes in patients who did and did not receive CT imaging. Prospective studies are stronger since data is collected moving forward in a more standardized way, which helps reduce bias and missing information. However, retrospective studies are still very helpful, especially in the emergency department, because they allow us to look at larger patient populations and reflect actual clinical practice. Both study types can show the diagnostic yield of CT scans and whether the findings actually led to a change in management, which directly answers the clinical question.

PICO search terms:

P	**I**	**C**	**O**
elderly	CT head	No Imaging	Change in management
geriatric	computed tomography	Selective imagining	Intracranial pathology
older adults	neuroimaging	Clinical Observation	Clinical decision making
advanced dementia	brain imaging	Conservative management	ED length of stay

Delirium			Mortality
altered mental status			
acute confusion			

Search tools and strategy used:

For PubMed i attempted different search terms including : (elderly OR geriatric OR older adults) AND (dementia OR cognitive impairment) AND (altered mental status OR AMS OR delirium OR confusion) AND (CT head OR head CT OR computed tomography) AND (diagnostic yield OR intracranial pathology OR change in management) and after using filters such as Last 10 years, Humans, English, age above 65 that resulted about 15 articles.

For Google scholar, I Searched using Terms: CT head elderly dementia altered mental status diagnostic yield with Filters focusing on articles within 10 years, Sorted by relevance and Peer reviewed which resulted about 406 articles in that i revied the first 2 pages.

Explain how you narrowed your choices to the few selected articles. For example, if your search returned 25 articles among the several databases used, what was the process used to determine which four articles to use? After obtaining the initial search results, I first screened articles based on title and abstract to identify studies that were most relevant to my clinical question. I focused on studies that included elderly patients presenting with altered mental status or delirium, since there were limited studies specifically on advanced dementia alone.

I excluded articles that focused on trauma-related CT imaging, those that included younger populations and did not evaluate diagnostic yield or impact on clinical management

From the remaining articles, I prioritized higher levels of evidence, such as systematic reviews when available, followed by well-designed cohort studies. I also focused on recent studies (within the last 5–10 years) and those conducted in emergency department or acute care settings to ensure clinical relevance.

Finally, I selected the four most relevant articles that directly evaluated the diagnostic yield of CT head imaging and whether the findings led to a meaningful change in management, as this best addressed my PICO question.

Results found:

1) **Use of Computed Tomography of the Head in Patients With Acute Atraumatic Altered Mental Status**

Acharya, R., Kafle, S., Shrestha, D. B., Sedhai, Y. R., Ghimire, M., Khanal, K., Malla, Q. B., Nepal, U., Shrestha, R., & Giri, B. (2022). Use of Computed Tomography of the Head in Patients

With Acute Atraumatic Altered Mental Status: A Systematic Review and Meta-analysis. *JAMA network open*, *5*(11), e2242805. https://doi.org/10.1001/jamanetworkopen.2022.42805

This article is a systematic review and meta-analysis.I chose this article because it represents the highest level of evidence available to answer my clinical question. It specifically evaluates the use of CT head imaging in patients with acute atraumatic altered mental status, which closely matches my patient population. The study includes a large sample size across multiple studies, making the findings more reliable and generalizable. This article is particularly useful because it not only looks at how often CT scans are used, but also evaluates the diagnostic yield. It also highlights the potential issue of overuse, which ties into the harms aspect of my question, including unnecessary radiation exposure and increased healthcare costs.

Abstract

Importance : The usefulness of computed tomography of the head (CTH) in patients with acute-onset atraumatic altered mental status (AMS) is poorly understood, but use in these patients remains high.

Objective To evaluate the use of CTH (event rate) in patients with AMS and the positive outcome event rate of the performed CTH studies.

Data Sources The PubMed/MEDLINE, PubMed Central, Embase, and CINAHL databases were searched using predefined Boolean parameters. All studies that met inclusion criteria until January 31, 2022, were included.

Study Selection Randomized clinical trials and observational, cohort, and case-control studies were included. Conference abstracts, reviews, letters, case reports, case series, systematic literature, and meta-analyses were excluded.

Data Extraction and Synthesis The systematic literature review was performed per Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines. Data were independently extracted by 2 authors. Data were pooled using a random-effects method.

Main Outcomes and Measures Event rate of CTH use in patients with acute atraumatic AMS. The CTH event rates and positive CTH event rates were calculated with 95% CIs.

Results Of 9338 studies identified, 26 qualified for the systematic review and 25 for the meta-analysis. The 25 studies in the meta-analysis included a total of 79 201 patients. The CTH event rate was 94% (proportion, 0.94; 95% CI, 0.76-1.00), and the positive CTH event rate was 11% (proportion, 0.11; 95% CI, 0.07-0.15). There was significant heterogeneity among the studies included ($I^2 > 50\%$, $P < .001$), for which a random-effects model was used. There was significant publication bias, as evident by an asymmetric funnel plot. There was no fluctuation of the results during the sensitivity analysis, which reassured the reliability of the data.

Conclusions and Relevance In this meta-analysis, CTH use among patients with acute-onset atraumatic AMS was very high with a low yield. Large-scale studies are needed to guide clinical decision-making in such a situation.

Key Findings

- This study included 25 studies with a total of 79,201 patients, making it a large and comprehensive analysis. CT head imaging was performed in a very high percentage of patients with altered mental status, with a reported utilization rate of 94%.
- Despite this high usage, the positive diagnostic yield was only 11%, meaning most CT scans did not show clinically significant findings. This suggests that CT head imaging is likely being overused in this patient population, especially in cases without clear risk factors.
- The article also emphasizes that CT imaging contributes to increased healthcare costs and radiation exposure, which are important harms to consider. It further notes that repeated CT exposure may increase long-term cancer risk, highlighting a potential long-term harmthat is often overlooked.
- Overall, the main conclusion is that CT head imaging in atraumatic AMS has a high rate of use but low diagnostic yield, and more evidence is needed to guide appropriate use.

2) **Head computed tomography for elderly patients with acute altered mental status in the emergency setting: value for decision-making and predictors of abnormal findings**

Gerlier, C., Forster, M., Fels, A., Zins, M., Chatellier, G., & Ganansia, O. (2022). Head computed tomography for elderly patients with acute altered mental status in the emergency setting: value for decision-making and predictors of abnormal findings. *Clinical and experimental emergency medicine*, *9*(4), 333–344. https://doi.org/10.15441/ceem.22.286

Abstract

Objective

This study evaluated the impact of head computed tomography (CT) on clinical decision-making about older adults with acute altered mental status (AMS) in the emergency department in terms of CT's diagnostic yield, emergency department length of stay, and changes in medical strategy. It also attempted to find predictors of an acute imaging abnormality.

Methods

This was a 1-year, retrospective, single-center observational study of patients aged ≥75 years who underwent noncontrast head CT because of an isolated episode of AMS. The acute positive CT findings were ischemic strokes, hemorrhages, tumors, demyelinating lesions, hydrocephalus, and intracranial infections.

Results

A total of 594 CTs were performed, of which 38 (6.4%) were positive. The main etiology of AMS was sepsis (29.1%). Changes in medical strategy were more common in patients with a positive CT, and the major changes were ordering additional neuro exams (odds ratio [OR], 95.3; 95% confidence interval [CI], 38.4–233.8; P<0.001), adjusting treatments (OR, 12.2; 95% CI,

5.0–29.5; P<0.001), and referral to a neurologic unit (OR, 7.3; 95% CI, 3.0–17.5; P<0.01). Three factors were significantly associated with a positive outcome: Glasgow Coma Scale <13 (OR, 8.5; 95% CI, 2.3–28.9; P<0.001), head wound (OR, 3.1; 95% CI, 1.1–8.2; P=0.025), and dehydration (OR, 0.3; 95% CI, 0.1–0.4; P=0.021). For elderly patients with a Glasgow Coma Scale ≥13 and no head wound or clinical dehydration, the probability of a positive CT was 0.02 (95% CI, 0.01–0.04). Considering only those patients, the diagnostic yield fell to 1.7%.

Conclusion

In elderly patients, the causes of AMS are primarily extracerebral. Randomized clinical trials are needed to validate a clinical pathway for selecting patients who require emergent neuroimaging.

This article is a retrospective cohort study. I chose this article because it directly evaluates the role of CT head imaging in elderly patients presenting with acute altered mental status in the emergency department, which closely matches my clinical scenario. Unlike broader studies, this article specifically looks at how CT imaging impacts clinical decision-making, including whether it leads to a change in medical management, which is a key outcome in my PICO question. This study is especially relevant because it focuses on real-world ED patients aged ≥75 years with isolated AMS, making it highly applicable to my patient population. It also goes beyond just reporting diagnostic yield and examines whether CT scans actually influence care, as well as their effect on ED length of stay, which adds to understanding potential downsides of routine imaging.

Key Findings

- The study included 594 CT scans performed in elderly patients with isolated AMS. The diagnostic yield was only 6.4%, meaning very few CT scans showed acute clinically significant findings.
- The most common causes of AMS were extracerebral, particularly sepsis (29.1%), suggesting that many cases do not require neuroimaging.
- Although CT findings were associated with changes in management, overall changes in medical strategy were rare, meaning CT scans often did not significantly alter care.
- CT use was associated with an increase in emergency department length of stay, highlighting a potential downside of routine imaging.
- Certain clinical factors increased the likelihood of a positive CT:
- In patients without risk factors such as GCS ≥13, no head wound, clinically dehydrated, the probability of a positive CT was extremely low (~1.7–2%).
- The study suggests that CT scans may be unnecessary in low-risk patients, supporting a more selective imaging approach rather than routine use.
- The authors conclude that most causes of AMS in elderly patients are non-neurologic, reinforcing the importance of clinical assessment over routine imaging.

3) **Head computed tomography findings in geriatric emergency department patients with delirium, altered mental status, and confusion: A systematic review**

Liu, S. W., Lee, S., Hayes, J. M., Khoujah, D., Lo, A. X., Doering, M., de Wit, K., & Geriatric Emergency Department Delirium Guidelines Group (2023). Head computed tomography findings in geriatric emergency department patients with delirium, altered mental status, and confusion: A systematic review. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine*, *30*(6), 616–625. https://doi.org/10.1111/acem.14622

Abstract

Background: Delirium, altered mental status (AMS), or confusion among older adults are common presentations to the emergency department (ED). We aimed to report the proportion of older ED patients presenting with delirium who have acute abnormal findings on head imaging. We also assessed whether anticoagulation, neurological deficits, trauma, or headache were associated with head imaging abnormalities in these patients.

Methods: A systematic review was performed using Ovid Medline, Embase, Clinicaltrials.gov, Web of Science, and Cochrane Central from conception to April 8, 2021. Citations were included if they described patients aged 65 years or older who received neuroimaging at the time of ED assessment for delirium, confusion, or AMS. Screening, data extraction, and bias assessment were performed in duplicate. The estimated proportion of patients with abnormal neuroimaging and odds ratios (ORs) for each predictor were calculated.

Results: The search strategy identified 3014 unique citations, of which six studies reporting on 909 patients with confusion or AMS were included. None of the studies formally diagnosed delirium. Overall, the proportions of older ED patients with AMS or confusion were found to have an abnormal head computed tomography (CT) was 15.6% (95% confidence interval [CI] 7.3%-26.2%). The prevalence of focal neurologic findings was 13.0% (66/506) and for anticoagulation was 9.8% (33/337) among the studies who reported them. The presence of a focal neurological deficit was associated with abnormal head CT (OR 101.8, 95% CI 30.5-340.1). Anticoagulation was not associated with abnormal head CT (OR 1.2, 95% CI 0.4-3.3). No studies reported on the association between headache or trauma and abnormal neuroimaging.

Conclusions: The proportion of abnormal findings on CT neuroimaging in older ED patients with AMS or confusion was 15.6%. The presence of a focal neurological deficit was a strong predictor for the presence of acute abnormality, whereas anticoagulation was not.

This is a systematic review. I chose this article because it focuses specifically on older adults presenting to the emergency department with altered mental status, delirium, or confusion, which closely matches my patient population. It evaluates how often CT head imaging actually shows acute abnormalities, making it directly relevant to assessing diagnostic yield.

This article is also important because it looks at clinical predictors of positive CT findings, which helps determine whether imaging should be done routinely or selectively. This directly supports my PICO question by helping identify which patients may actually benefit from CT imaging rather than scanning everyone.

Key Points

- The systematic review identified over 3,000 citations, but only 6 studies (909 patients) met inclusion criteria, showing that high-quality data in this area is limited.
- The overall proportion of abnormal CT findings in older ED patients with AMS/confusion was 15.6%, meaning most scans were negative.
- The presence of a focal neurologic deficit was a very strong predictor of an abnormal CT, with a very high odds ratio (~100), making it one of the most important clinical indicators for imaging.
- Anticoagulation was not significantly associated with abnormal CT findings, which challenges the assumption that all anticoagulated patients need imaging.
- None of the included studies formally diagnosed delirium using standardized criteria, which is an important limitation and affects how results are interpreted.
- The article highlights that there is no clear consensus or guideline on when CT should be obtained in elderly patients with AMS or delirium, leading to variability in practice.
- Overall, the study suggests that CT imaging has a relatively low diagnostic yield, and that clinical features (especially focal deficits) should guide decision-making rather than routine imaging.

What is the clinical "bottom line" derived from these articles in answer to your question?

Overall, the evidence shows that routine CT head imaging in elderly patients with atraumatic altered mental status has a low diagnostic yield and rarely leads to a meaningful change in management, so it should not be done automatically in every patient. Most scans do not reveal a clinically significant intracranial cause, and the likelihood of a positive finding is especially low in patients without focal neurologic deficits, head trauma, or significant changes in consciousness. In these lower-risk patients, CT imaging may only add unnecessary testing, longer ED stays, and potential downstream harm, rather than improving outcomes.

Because of this, a more selective approach to imaging is recommended, where CT is reserved for patients with higher-risk clinical features. However, in real clinical practice, this can be difficult to apply. In the ED, CT scans are often still performed due to uncertainty, limited history, or the need to reassure the care team and family. This is a case I saw during ED rotation and in this situation the team had to discuss with the family whether to proceed with a CT scan. The family was hesitant because the patient was already deteriorating and had advanced dementia, and they did not want her to go through additional interventions if it would not meaningfully change her

care. In patients with advanced dementia or limited goals of care, the decision becomes even more nuanced, as imaging is unlikely to change management. In these situations, it is important to balance the low benefit of CT imaging with the patient's overall condition and have thoughtful discussions with the family to guide care decisions.