



## Over the hill and falling down: Can the NEXUS criteria be applied to the elderly?



Amani Jambhekar\*, Ryan Lindborg, Vincent Chan, Adriana Fulginiti, Bashar Fahoum, James Rucinski

Department of Surgery, New York Presbyterian Brooklyn Methodist Hospital, Brooklyn, NY, USA

### ARTICLE INFO

#### Keywords:

NEXUS criteria  
Low risk criteria  
Cervical spine injury

### ABSTRACT

**Introduction:** The National Emergency X-Radiography Utilization Study (NEXUS) criteria have been criticized due to the presumed unreliability of the clinical exam in elderly patients. The objective of this study was to determine if the NEXUS criteria can be safely applied to this vulnerable group of patients.

**Methods:** 596 trauma patients over the age of 65 were enrolled in a prospectively designed study between April 1, 2015 and October 1, 2016. The study was designed to encourage the use of the NEXUS criteria for all trauma patients including the elderly. NEXUS-negative patients (n = 226) were defined as individuals fulfilling none of the low risk criteria. The specificity and sensitivity of the NEXUS criteria were calculated based on any cervical spine injuries which were missed in NEXUS-positive patients (n = 129) who met one or more criteria.

**Results:** Out of the 596 included elderly patients, 355 patients underwent computed tomography (CT) of the cervical spine. 129 patients were NEXUS-positive and in this group ten nonoperative cervical spine injuries were detected. There were no NEXUS-positive patients who did not undergo CT scans of the cervical spine. No cervical spine injuries were detected in the 226 NEXUS-negative patients. In elderly patients, the NEXUS criteria had a sensitivity of 100% and specificity of 100%.

**Conclusion:** The NEXUS criteria have been criticized in prior literature as less sensitive in elderly patients. Based on the current study, the use of the NEXUS criteria may lead to decreased radiation exposure and healthcare costs allowing for better allocation of resources for patients who warrant imaging of the cervical spine.

### 1. Introduction

The National Emergency X-ray Utilization Study (NEXUS) low-risk criteria is a clinical decision-making tool devised independently to facilitate more selective cervical spine imaging and to expedite exclusion of cervical spine injury in trauma patients [1–3]. More recently, the Canadian C-spine Rule was designed to combat the low specificity of the NEXUS criteria and further reduce needless imaging of the cervical spine [4]. Several large studies have shown it to be more sensitive and specific than the NEXUS criteria [4,5], however the NEXUS criteria are currently still widely used by emergency physicians and are frequently taught to junior doctors and medical students because of their simplicity [3]. They have been criticized for use in the elderly population due to the decreased sensitivity of the clinical exam in patients who may suffer from baseline dementia or alterations in mental status [6]. Several studies have attempted to modify the NEXUS criteria for use in the elderly while still keeping them easy to recall [7,8]. The objective of this study was to determine if the original NEXUS criteria can be safely

applied to the elderly.

### 2. Methods

Data was prospectively collected on 596 trauma patients who were evaluated between April 1, 2015 and October 1, 2016. Patients were included in the study if they were over the age of 65 and were evaluated by Trauma Surgery. Out of the 596 included elderly patients, 355 patients received CT scans for the cervical spine based on provider discretion. All providers were encouraged to use the NEXUS criteria with a real time electronic decision support tool reminding them of the specific tenets of NEXUS, however providers could list alternate reasons for which they ordered imaging of the cervical spine. The most common alternate reason for ordering CT scans of the cervical spine was an unreliable history of trauma. Other reasons providers felt more comfortable ordering these scans included advanced age, dangerous mechanism of injury, and history of anticoagulation. The elderly cohort was part of a larger study designed to encourage the use of the NEXUS

\* Corresponding author. New York Presbyterian Brooklyn Methodist Hospital Department of Surgery, 506 Sixth Street, Brooklyn, NY 11215, USA.  
E-mail address: [Amani.jambhekar@gmail.com](mailto:Amani.jambhekar@gmail.com) (A. Jambhekar).

**Table 1**  
NEXUS criteria.

Focal neurologic deficit present
Midline spinal tenderness present
Altered level of consciousness present
Intoxication present
Distracting injury present

criteria with the electronic decision support tool as well as targeted educational sessions and pocket reference cards. NEXUS-positive patients were defined as patients who met one or more of the low risk criteria and therefore were not considered low risk for cervical spine injury. NEXUS-negative patients were defined as those who met none of the criteria (Table 1). The study was reviewed and accepted by the Institutional Review Board and the work has been reported in line with the STROCSS criteria [20].

The study was conducted at an American College of Surgeons provisionally verified Level 2 trauma center which received trauma center designation on April 1, 2015. The hospital in the study is a 651 bed facility that receives over 100,000 ED visits per year, serving an urban population of 2.6 million people within a metropolitan area of more than 20 million residents. The trauma program was started to provide trauma care to the community as well as facilitate postgraduate education in trauma. Only patients who were seen by both Trauma Surgery and the Emergency Department teams were included; those patients who were evaluated exclusively by the Emergency Department were excluded from the study.

**3. Results**

The study population was on average 81.1 ± 8.8 years old. The mechanisms of injury ranged from falls from a seated position to pedestrians struck. The majority of elderly patients suffered falls from standing or less than 3 feet (n = 503; 84.4%) followed by falls greater than 3 feet (n = 34; 5.7%) and pedestrians struck (n = 17; 2.9%). The patients had an average Injury Severity Score (ISS) of 6.6 ± 5.1 with an average length of stay of 5.1 ± 4.7 days. Most patients were admitted (95.6%); of those half were ultimately discharged to skilled nursing facilities (48.1%). 355 patients out of the 596 (59.6%) received cervical spine imaging. Of the 355 patients, 129 were NEXUS-positive and therefore met criteria for additional workup (36.3%). Out of the entire population of 596 patients, 21.6% were NEXUS positive. The remaining 226 patients underwent CT scans of the cervical spine due to other reasoning as per each individual provider. Out of the 355 patients who received a CT scan, only 10 had cervical spine injuries, making the overall incidence 1.7% out of the initial population of 596 patients. There were no missed injuries in the 226 NEXUS-negative patients who underwent CT of the cervical spine (0%). Those 226 NEXUS-negative patients who did not undergo CT of the cervical spine were followed clinically with no further imaging. No missed cervical injuries were documented during the tertiary survey by daily resident and attending physician examinations prior to discharge or on outpatient follow up within 2 weeks by neurosurgery.

Of the ten patients with cervical spine injuries, none required operative intervention (Table 2). All of the patients were discharged with a hard collar and seen by Neurosurgery for flexion-extension x-radiography on an outpatient basis.

**4. Discussion**

Several studies have called into question the sensitivity of the NEXUS criteria in the elderly given the presumed unreliability of the clinical exam (Table 3) [3,6,9,10]. One large retrospective review found the NEXUS criteria had a sensitivity of 65.9% and negative predictive value of 92.2% in elderly patients [9] and concluded that CT imaging

**Table 2**  
Characteristics of cervical spine injuries.

Age	Mechanism	Indication for imaging	Cervical level	Injury
93F	Found down	Midline cervical tenderness	C2	Vertebral body
92M	Fall from sitting	Midline cervical tenderness	C5-C6	Endplate
92F	Fall down 7 stairs	Midline cervical tenderness Altered level of consciousness	C1 C2 C7	Anterior ring Vertebral body Spinous process
87F	Fall from standing	Midline cervical tenderness	C2	Vertebral body
84F	Fall down 12 stairs	Midline cervical tenderness	C1 C2	Anterior ring Vertebral body
83F	Fall from standing	Midline cervical tenderness	C1	Anterior ring
77M	Pedestrian struck	Midline cervical tenderness	C1	Lamina
74F	Fall down 3 stairs	Midline cervical tenderness	C2	Vertebral body Transverse foramen
71M	Fell off ladder + flight of stairs	Focal neurologic deficit	C4 C5 C6	Vertebral body Spinous process Spinous process
68F	Unwitnessed fall	Altered level of consciousness	C5	Spinous process

should be used for all elderly blunt trauma patients regardless of the NEXUS criteria. Additionally, a study of 169 elderly patients showed the NEXUS criteria demonstrated 81.8% sensitivity and 95.9% negative predictive value in detecting any cervical spine injury. However, the study revealed 88.9% sensitivity and 98% negative predictive value in detecting clinically significant injuries.[11] They also concluded that due to the high incidence of cervical spine injury (6.5%), CT imaging should be considered for every elderly patient. Several smaller studies have also warned against the use of the NEXUS criteria with missed injuries in NEXUS-negative patients [3,6,12]. One study reported two missed injuries in a cohort of 51 elderly patients.[6]

A follow up to the original NEXUS study, however, reported 100% sensitivity in the NEXUS dataset in detecting clinically significant cervical spine injuries in 2943 elderly patients. The two injuries detected in NEXUS-negative patients were deemed clinically insignificant – avulsion fractures of the lateral mass of C2.7 Additionally, several studies applied modified NEXUS criteria using the patient's baseline mental status as a substitute for altered level of consciousness and face and head trauma as the only distracting injuries and found 100% sensitivity [8,13]. Although the concept of a distracting injury has been contested in the literature [14,15], studies have shown that patients able to follow complex commands are able to reliably indicate tenderness of the cervical exam during physical examination [5,16]. No studies have specifically examined the sensitivity of the clinical exam in elderly patients with altered mental status. Therefore the modified NEXUS criteria were not applied in the current study and as such, would have missed one patient with an altered level of consciousness who was at his baseline mental status. The patient presented after suffering multiple unwitnessed falls prompting several Emergency Department visits over one week. According to his wife he was at his baseline mental status which had worsened over the last month with an increase in forgetfulness, confusion, and agitation. Although he was able to follow commands, he was scanned and a C5 spinous process fracture was detected along with other injuries giving him an injury severity score of 9. He had no facial or head trauma which would be considered a distracting injury. Had the modified NEXUS criteria been applied, this cervical spine injury would have been missed although it did not require operative intervention.

Although the incidence of cervical spine injury is higher in elderly

Download English Version:

<https://daneshyari.com/en/article/8832033>

Download Persian Version:

<https://daneshyari.com/article/8832033>

[Daneshyari.com](https://daneshyari.com)