

Decision-making criteria for CT head scans on patients not on anti-coagulants

Citation Yap G, Clay F. and Melder A. 2018. The use of CT brain scans post-fall. Rapid Review. Centre for Clinical Effectiveness, Monash Health, Melbourne, Australia.

Executive Summary

Background

The Centre for Clinical Effectiveness provided the Falls Committee with a review around post-fall management of patients on anti-coagulants. In an extension of the rapid review request, the Committee are also investigating post-fall management, specific to the use of brain CT scans after a fall for non-anticoagulated patients.

Objective

To provide a review of guidelines and synthesised evidence around the use of brain CT scans after a fall. For the purpose of the review, post-fall guidelines and literature around minor head injuries will be included.

Search Strategy

A recent CCE scoping review: Head Injury and Patients on Anticoagulant/Antiplatelet Therapies (2017) included evidence for patients on anticoagulants and hence findings from this previous review were not relevant ^[1]. However, reference mining from this previous review will aim to identify relevant sources of information. Specific guideline databases (NHMRC, NICE) and one medical database (PubMed) was searched according to the search strategy and inclusion criteria in Table 1.

Results

Five relevant documents were identified, of which three were guideline documents. Two documents were published by the National Institute of Health and Care Excellence (NICE), one of which was a high quality evidence based guideline ^[2]; two guideline documents for the post-fall multidisciplinary management of inpatients in WA healthcare settings ^[3] and ACR Appropriateness Criteria in the management of head trauma, respectively ^[4]; and one review of evidence on the indications for CT scans in minor head injuries ^[5].

[Table 2](#) provides a summary of the included documents.

[Table 3](#) sets out the guidelines for indications for when to perform a CT head scan

Conclusions

There is no specific research determining the optimal pathway for CT scans in adult post-fall inpatients ^[3]. The National Institute for Health Care and Excellence (NICE) guidelines developed for Emergency Departments provide useful criteria for clinicians to assist decision-making for when to perform head CT scans ^[2].

The New Orleans Criteria, Canadian Computed Tomography Head Rule, and National Emergency X-Ray Utilization Study are published guidelines with high sensitivity for identifying patients with minor or mild acute closed head injury who can avoid neuroimaging ^[4]. However, The Canadian Computed Tomography Head Rule is found to be the most reliable instrument meeting the criteria for CT head scans, characterised by excellent sensitivity of 100% and fairly good specificity of 48–77% ^[5].

Whether a CT head scan will alter patient management and patient/carer preferences should be also considered, documented in the patient's health care record and discussed with the treating specialist ^[3].

Summary of Results

Table 2. Summary of documents included in the review

Reference	Title	Context	Quality of document	Quality of the evidence
NICE guideline CG 176 ^[2]	Head injury: assessment and early management	Evidence based guidelines for the assessment and early management of head injury in children, young people and adults	High	Majority of evidence in adults were of moderate quality.
NICE algorithm, CG 176 ^[6]	Algorithm 1: Selection of adults for CT head scan	Flow chart for adults presenting to the emergency department who have sustained a head injury	High; based on its link to evidence (CG 176)	-
WA post fall guideline 2018 ^[3]	Post Fall Multidisciplinary Management Guidelines for Western Australian Health Care Settings 2018	Guidelines for use by all health professionals employed in inpatient facilities and multi-purpose sites	Moderate	Not mentioned
Shetty et al. 2016 ^[4]	ACR Appropriateness Criteria Head Trauma	Evidence based guidelines on the role of neuroimaging in the management of head trauma	Moderate	Thirteen (out of 64 references) well-designed or good-quality studies provide good evidence.
Zyluk et al. 2015 ^[5]	Indications for CT scanning in minor head injuries: A review	Review of evidence for everyday clinical practice decision-making in patients with minor head injuries	-	Not mentioned

Synthesis of Results

Table 3. Guidelines for indications for when to perform a CT head scan

	NICE CG 176 (2014) [2,6]	WA Post-fall Guidelines (2018) [3]	Shetty <i>et al.</i> (2016) [4]	Zyluk <i>et al.</i> (2015) [5]
Title of document	Head injury: assessment and early management	Post Fall Multidisciplinary Management Guidelines for Western Australian Health Care Settings 2018	ACR Appropriateness Criteria Head Trauma	Indications for CT scanning in minor head injuries: A review
Statement on evidence and/or how the guidelines were developed	<ul style="list-style-type: none"> Includes validated clinical decision rules, and excludes studies deriving new adult clinical decision rules. The Guideline Development Group (GDG) recommends clinical decision rules that had been well tested in relevant populations. Full literature searches, critical appraisals and evidence reviews were completed to address the question: "What is the best clinical decision rule for selecting adults, infants and children with head injury for CT head scan?" 	<ul style="list-style-type: none"> Literature review and extensive consultation of multidisciplinary health professionals, unregulated health care workers, and consumers from across WA was undertaken. Further details were not mentioned in the document, but can be requested. A community guideline for post-fall care is also available on request. 	<ul style="list-style-type: none"> The ACR Appropriateness Criteria are evidence-based guidelines for specific clinical conditions that are reviewed every three years by a multidisciplinary expert panel. Includes an extensive analysis of current medical literature from peer-reviewed journals and the application of a well-established consensus methodology (modified Delphi) to rate the appropriateness of imaging and treatment procedures by the panel. Where evidence is lacking or not definitive, expert opinion may be used to recommend imaging or treatment. 	<ul style="list-style-type: none"> The review presents several clinical decision rules which have been tested in clinical practice and reports the results of their use.
<u>Criteria for patient selection for CT head scans</u>	<p>Criteria for performing a CT head scan</p> <p>For adults who have sustained a head injury and have any of the following risk factors, perform a CT head scan within 1 hour of the risk factor being identified:</p> <ul style="list-style-type: none"> GCS less than 13 on initial assessment in the emergency department. GCS less than 15 at 2 hours after the injury on assessment in the emergency department. Suspected open or depressed skull fracture. Any sign of basal skull fracture (haemotympanum, 'panda' eyes, cerebrospinal fluid leakage from the ear or nose, Battle's sign). Post-traumatic seizure. 	<p>When to perform a CT head scan within 1 hour for patient who have hit their head</p> <p>For adults who have sustained a head injury and have any of the following risk factors, perform a CT head scan within one hour of the risk factor being identified:</p> <ul style="list-style-type: none"> GCS less than 13 on initial assessment. GCS less than 15 at 2 hours after the injury on assessment. Suspected open or depressed skull fracture. Any sign of basal skull fracture (haemotympanum, 'panda eyes', cerebrospinal fluid leakage from the ear or nose, Battle's sign). Post-traumatic seizure. Focal neurologic deficit. 	<p>Three Major Prediction Rules Used to Identify Patients With Minor or Mild Acute Closed Head Injury Who Can Safely Avoid Undergoing Non-contrast Head CT</p> <p>Canadian CT Head Rule (CCHR)</p> <p><i>Exclusion criteria</i></p> <ul style="list-style-type: none"> Age < 16 years Minimal head injury (no loss of consciousness amnesia, or disorientation) No clear history of trauma as the primary event Obvious penetrating skull injury or depressed skull fracture Acute focal neurologic deficit Unstable vital signs associated with major trauma Had seizure before assessment 	<p>Canadian CT Head Rule</p> <p>Inclusion criteria: Patient with minor head injury who present with a GCS score of 13–15, after witnessed loss of consciousness, amnesia or confusion. CT is only required for patients with any of the following findings</p> <p><i>High risk of neurosurgical intervention</i></p> <ul style="list-style-type: none"> Glasgow Coma Score lower than 15, at 2 h after injury Suspected open or depressed skull fracture Any sign of basal skull fracture ^a Two or more episodes of vomiting after trauma Age 65 years or older <p><i>Medium risk of brain injury detection</i></p>

	NICE CG 176 (2014) [2,6]	WA Post-fall Guidelines (2018) [3]	Shetty <i>et al.</i> (2016) [4]	Zyluk <i>et al.</i> (2015) [5]
	<ul style="list-style-type: none"> • Focal neurological deficit. • More than 1 episode of vomiting. • Head injury: assessment and early management (CG176) • A provisional written radiology report should be made available within 1 hour of the scan being performed. [new 2014] <p>For adults with any of the following risk factors who have experienced some loss of consciousness or amnesia since the injury, perform a CT head scan within 8 hours of the head injury:</p> <ul style="list-style-type: none"> • Age 65 years or older. • Any history of bleeding or clotting disorders. • Dangerous mechanism of injury (a pedestrian or cyclist struck by a motor vehicle, an occupant ejected from a motor vehicle or a fall from a height of greater than 1 metre or 5 stairs). • More than 30 minutes' retrograde amnesia of events immediately before the head injury. • A provisional written radiology report should be made available within 1 hour of the scan being performed. [new 2014] 	<ul style="list-style-type: none"> • More than one episode of vomiting. <p>When to perform a CT head scan within 8 hours for patients who have hit their head</p> <p>For adults with any of the following risk factors who have experienced some loss of consciousness or amnesia since the injury, perform a CT head scan within 8 hours of the head injury:</p> <ul style="list-style-type: none"> • Age 65 years or older. • Any history of bleeding or clotting disorders. • Current anticoagulation treatment. • Dangerous mechanism of injury (a pedestrian or cyclist struck by a motor vehicle, an occupant ejected from a motor vehicle or a fall from a height of greater than one metre or five stairs). • More than 30 minutes' retrograde amnesia of events immediately before the head injury. <p>Patients who had a witnessed fall and did NOT hit their head, do NOT need a CT head scan unless signs of neurological impairment develop.</p> <p>Patients who had an unwitnessed fall with no signs of head injury, may consider a CT head scan if:</p> <ul style="list-style-type: none"> • Cognitively impaired. • Neurological deterioration on nursing observations. • On current anticoagulant treatment. 	<p>in the emergency department</p> <ul style="list-style-type: none"> • Has a bleeding disorder or is anticoagulated • Return visit to emergency department for reassessment of same head injury • Pregnancy <p><i>Head CT is not required if all of the following are absent:</i></p> <ul style="list-style-type: none"> • GCS score < 15 at 2 hours postinjury • Suspected open or depressed skull fracture • Any sign of basilar skull fracture (hemotympanum, raccoon eye, CSF otorrhea or rhinorrhea, Battle sign) • Two or more episodes of vomiting • Age ≥ 65 years • Amnesia before impact ≥ 30 minutes • Dangerous mechanism (pedestrian struck by vehicle, ejection from motor vehicle, fall from elevation >3 feet or five steps) <p>New Orleans Criteria (NOC)</p> <p>Inclusion criteria</p> <ul style="list-style-type: none"> • GCS score 15 • Age > 18 years • Blunt head trauma occurring within 24 hours and • causing loss of consciousness, amnesia, or • disorientation <p>Head CT is not required if all of the following are absent:</p> <ul style="list-style-type: none"> • Headache • Vomiting • Age > 60 years • Alcohol or drug intoxication • Deficits in short-term memory 	<p>by CT</p> <ul style="list-style-type: none"> • Amnesia before impact of more than 30 min • “Dangerous” mechanism of injury^b <p><i>a Signs of basal skull fracture: raccoon eyes, cerebrospinal fluid rhinorrhea or otorrhea, blood otorrhea, hemotympanum.</i></p> <p><i>b Dangerous mechanism: a pedestrian struck by a car, an occupant ejected from the motor vehicle, fall from an elevation of >1 m or 5 stairs.</i></p>

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			<ul style="list-style-type: none"> • Visible trauma above clavicles • Seizure <p>National Emergency X-Ray Utilisation Study (NEXUS)</p> <p>Head CT is not required if all of the following are absent:</p> <ul style="list-style-type: none"> • Age \geq 65 years • Evidence of significant skull fracture • Scalp hematoma • Neurologic deficit • Altered level of alertness • Abnormal behavior • Coagulopathy • Recurrent or forceful vomiting 	
Conclusions	<ul style="list-style-type: none"> • Refer to Figure 1. Algorithm NICE guidance for patient selection for CT scans [6] 	<ul style="list-style-type: none"> • There is no specific research determining the optimal pathway for inpatients. • The National Institute for Health Care and Excellence (NICE) guidelines developed for Emergency Departments provide useful criteria for clinicians to assist decision-making. • Sites without available CT scanning should utilise local pathways and consultation services. Deterioration in neurological observations undertaken by nursing staff is a trigger for CT scanning. 	<ul style="list-style-type: none"> • The New Orleans Criteria (NOC), Canadian Computed Tomography Head Rule (CCHR), and the National Emergency X-Ray Utilization Study (NEXUS II) are published guidelines with high sensitivity for identifying patients with minor or mild acute closed head injury who can avoid neuroimaging. • For minor or mild acute (GCS score \geq 13) to moderate or severe closed head injury (GCS score $<$ 13), imaging indicated by NOC, CCHR, or NEXUS II clinical criteria rates CT head without contrast to be usually appropriate. 	<ul style="list-style-type: none"> • The Canadian Computed Tomography Head Rule was found to be the most reliable instrument meeting these criteria, characterised by excellent sensitivity of 100% and fairly good specificity of 48–77%. • Remaining scales, although sensitive, showed poor ability to reduce number of “unnecessary” CT scans

Full report

Background

The Centre for Clinical Effectiveness provided the Falls Committee with a review around post-fall management of patients on anti-coagulants. In an extension of the rapid review request, the Committee are also investigating post-fall management, specific to the use of brain CT scans after a fall for non-anticoagulated patients.

Objectives

To provide a review of guidelines and synthesised evidence around the use of brain CT scans after a fall.

Scope

For the purpose of the review, post-fall guidelines and literature around minor head injuries will be included. Literature around head or brain CT scans was included.

Search strategy

Inclusion/Exclusion Criteria – See Table 1 in Appendix

Search strategy

The CCE scoping review: Head Injury and Patients on Anticoagulant/Antiplatelet Therapies (2017) included evidence for patients on anticoagulants and hence findings from this previous review were not relevant. However, reference mining from this previous review will aim to identify relevant sources of information. Specific guideline databases (NHMRC, NICE) and one medical database (PubMed) was searched according to the search strategy and inclusion criteria in Table 1.

Study Selection

Titles and abstracts identified were exported to EndNote X7 (Thompson, Reuters, Carlsbad, California, USA). Papers identified were screened using inclusion and exclusion criteria established a priori. Searches of Medline, specific guideline websites were screened by one reviewer in consultation with colleagues as necessary. Literature was included based on the above criteria in Table 1.

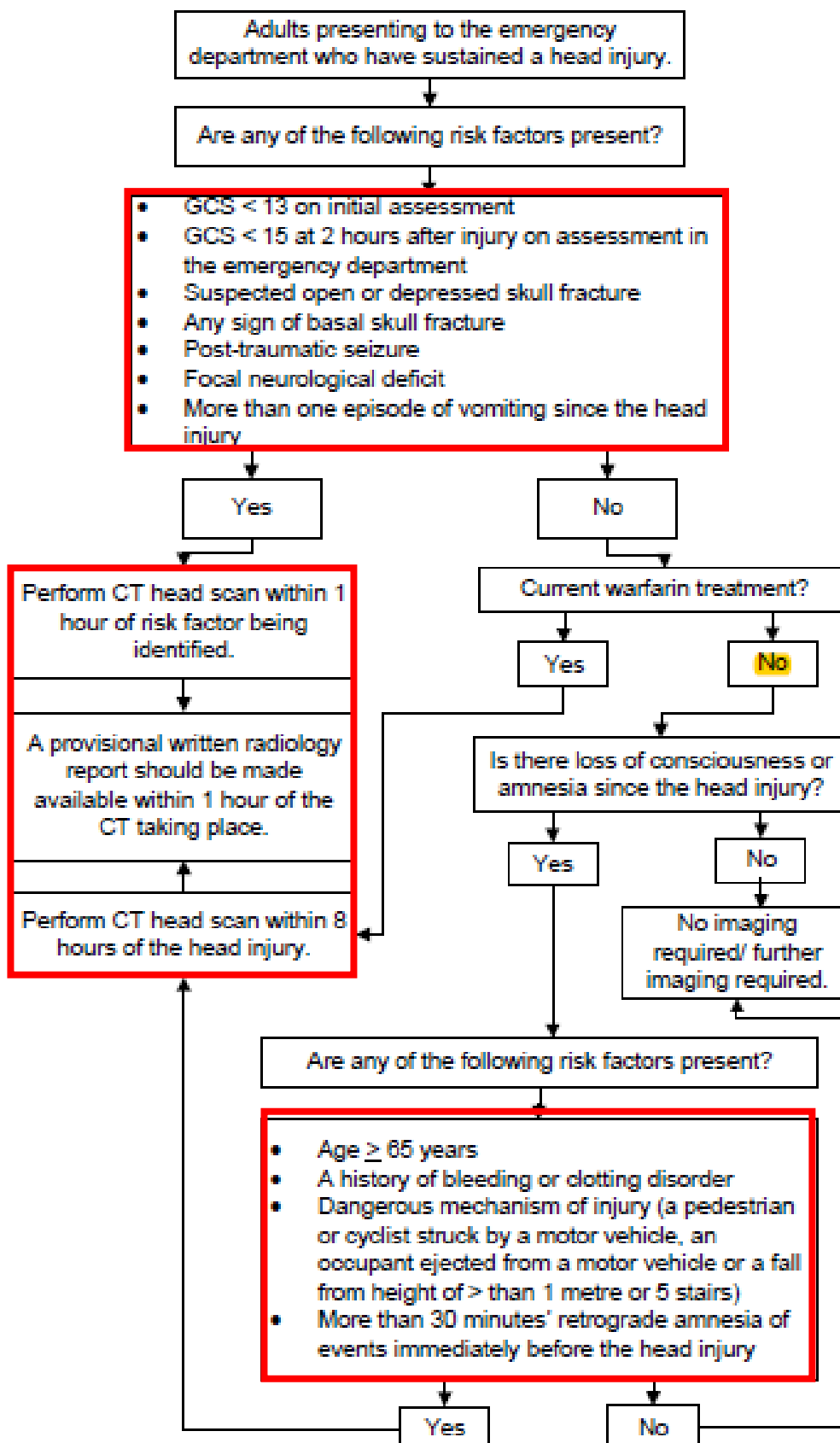
Results

Five relevant documents were identified, of which three were guideline documents. Two documents were published by the National Institute of Health and Care Excellence (NICE), one of which was a high quality evidence based guideline^[2]; two guideline documents for the post-fall multidisciplinary management of inpatients in WA healthcare settings^[3] and ACR Appropriateness Criteria in the management of head trauma, respectively^[4]; and one review of evidence on the indications for CT scans in minor head injuries^[5]. Table 2 provides a summary of the included documents.

See **Table 2 and 3** for summary of findings

Figure 1. Algorithm NICE guidance [6]

Algorithm 1: Selection of adults for CT head scan



Discussion

As there is no specific research determining the optimal pathway for inpatients, Western Australia post fall guidelines 2018 refer to the National Institute for Health Care and Excellence (NICE) guidelines CG 176 [3]. Furthermore, the NICE algorithm (Figure 1) provides a clear adult patient selection criteria for CT head scans. [6]

Other scales that are currently used to assess the need for CT scans in patients presenting with head injury at Emergency Departments include the New Orleans Criteria (NOC), Canadian Computed Tomography Head Rule (CCHR), and National Emergency X-Ray Utilization Study (NEXUS II). These are published guidelines with high sensitivity for identifying patients with minor or mild acute closed head injury who can avoid neuroimaging [4]. It is recommended that for minor or mild acute (GCS score \geq 13) to moderate or severe closed head injury (GCS score $<$ 13), imaging indicated by NOC, CCHR, or NEXUS II clinical criteria rates CT head scans without contrast are usually appropriate [4]. Authors did not compare between the three criteria as the purpose of the review was to determine what type of scan was considered to be appropriate (i.e. contrast vs non-contrast, MRI etc). However, in another review, the Canadian Computed Tomography Head Rule was found to be the most reliable instrument meeting these criteria, characterised by excellent sensitivity of 100% and fairly good specificity of 48–77%. Remaining scales (i.e., NOC, other assessment criteria), although sensitive, showed poor ability to reduce number of “unnecessary” CT scans [5].

It is important to consider whether a CT head scan will alter patient management and patient/carer preferences or if the patient would be considered appropriate for neurosurgical intervention. This dialogue should be documented in the patient’s health care record and discussed with the treating specialist [3].

Sites without available CT scanning should utilise local pathways and consultation services. Deterioration in neurological observations undertaken by nursing staff is a trigger for CT scanning [3].

Conclusions

There is no specific research determining the optimal pathway for CT scans in adult post-fall inpatients [3]. The National Institute for Health Care and Excellence (NICE) guidelines developed for Emergency Departments provide useful criteria for clinicians to assist decision-making for when to perform head CT scans [2,6].

The New Orleans Criteria, Canadian Computed Tomography Head Rule, and National Emergency X-Ray Utilization Study are published guidelines with high sensitivity for identifying patients with minor or mild acute closed head injury who can avoid neuroimaging [4]. However, *The Canadian Computed Tomography Head Rule* is found to be the most reliable instrument meeting the criteria for CT head scans, characterised by excellent sensitivity of 100% and fairly good specificity of 48–77% [5].

Whether a CT head scan will alter patient management and patient/carer preferences should be also considered, documented in the patient’s health care record and discussed with the treating specialist [3].

References

1. Garrubba M. 2017. Head Injury and Patients on Anticoagulant/Antiplatelet Therapies. Scoping Review. Centre for Clinical Effectiveness, Monash Innovation and Quality, Monash Health, Melbourne, Australia
2. National Institute of Health and Care Excellence. 2014. Head Injury: Triage, assessment, investigation and early management of head injury in children, young people and adults. NICE. Accessed March 2016. <https://www.nice.org.uk/guidance/cg176/evidence/full-guideline-191719837>
3. Western Australian Department of Health. WA Multidisciplinary Post Fall Management Guidelines 2018. Perth: Post Fall Working Group Western Australia; 2018.
4. Shetty A.S. et al. ACR Appropriateness Criteria Head Trauma. J Am Coll Radiol 2016;13:668-679.
5. Żyluk A. Indications for CT scanning in minor head injuries: A review. Neurologia I Neurochirurgia Polska. 2015; 49: 52-57
6. National Institute of Health and Care Excellence. 2014 Algorithm 1: Selection of adults for CT head scan. Accessed October 2018. <https://www.nice.org.uk/guidance/cg176/resources/imaging-algorithm-pdf-498950893>

Appendix 1

Table 1. Inclusion/Exclusion criteria

Population	Include: Adults not on anti-coagulants Exclude: Paediatric
Interventions	Include: Brain CT scans
Context	Include: Minor head injuries Exclude: Major trauma head injuries
Outcomes	Guidelines for the use of brain CT scans
Types of evidence	Include: Guidelines, synthesised literature (systematic reviews)
Limits	Date: 2015 – 2018 Language: Publications in English.
Database	Medical: PubMed Guidelines: NHMRC, NICE

Table 4. Information sources and search terms

Information sources	
Medical	Guidelines
PubMed	Clinical Practice Guidelines Portal (NHMRC)
	The National Institute for Health and Care Excellence (NICE)
Search Terms	
Terms around “head scans”	

Table 5. Database Search Terms

Search terms in PubMed	
1	Craniocerebral Trauma/
2	head trauma.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
3	1 or 2
4	exp Subarachnoid Hemorrhage/
5	exp Cerebral Hemorrhage/
6	exp Intracranial Hemorrhages/
7	exp Hematoma, Subdural/
8	Intracranial Hemorrhage, Traumatic/

9	Intracranial Hematoma.mp.
10	exp Basal Ganglia Hemorrhage/
11	(Intracranial or cerebral) and bleed*).mp.
12	4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13	3 or 12
14	limit 13 to (english language and humans and yr="2015 -Current")