XIII congresso nazionale
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GENOVA 30 MAG - 1 GIU 2024

I.MEU
Ruolo.Talento.Passione.Idee

Implicazioni nella Gestione del Trauma Cranico Lieve: Considerazioni sull'impatto degli Operatori nei Processi

Giuseppe Carpinteri
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A.O.U. Policlinico G. Rodolico – San Marco Catania

DEA II LIVELLO

2019: 65.000 adulti
2023: 52.000 adulti

Azienda Ospedaliero-Universitaria G. Rodolico
CATANIA

O.B.I. (14 pl)
T.S.I. (13 pl)

Tanti Cari Specializzandi!
Grazie!!!

HUB: CARDIO-TORACO-VASCOLARE

HUB: POLITRAUMA PEDIATRICO

L’esperienza del nostro DEA - 2023

Traumi cranici totali 1157

- Severi 12 →
  - NCH 6
  - Rianimazione 5
  - Deceduti 1
- Moderati 55 → SubIntensiva: 15
- Lievi 1090 (94%)
  - Permanenza in P.S. >24 ore: 180

STUDIO OSSERVAZIONALE

Gennaio-marzo 2023: 101 pazienti consecutivi con trauma cranico minore (mTBI) sottoposti a TC encefalo.
I pazienti reclutati, previa acquisizione del consenso informato, sono stati sottoposti al dosaggio di:

GFAP e UCH_L1

(Glial Fibrillary Acidic Protein e Ubiquitin Carboxyl-Terminal Hydrolase L1)

Criteri di inclusione:
- Età ≥ 18 anni al momento dell'arruolamento,
- Glasgow Coma Scale di 14-15 al momento dell'acquisizione del Consenso Informato,
- Trauma cranico verificatosi entro le 12 ore,
- Soggetto capace di leggere, capire e firmare il Consenso Informato

Criteri di esclusione:
- Partecipazione concomitante ad un qualsiasi studio clinico terapeutico e interventistico,
- Diagnosi primaria di ictus ischemico o emorragico,
- Tempistica del trauma cranico non nota e indeterminabile

Endpoint primario

Scopo dello studio è stato quello di valutare l'efficacia dei due biomarcatori *GFAP e UCH-L1* nel predire la necessità di eseguire una TC encefalo nei soggetti in studio (Espresso in Valore Predittivo Negativo)

CASISTICA

COMPLETATO LE STUDIO 97 PAZIENTI	
ETA MEDIA	62,3 ±21
M	47
F	50
TEMPO TRASCORSO TRA TRAUMA E PRELIEVO h	3,6 ±2,9
GCS MEDIO	15

ANTICOAGULATI	8
ASPIRINA	28 (3)
ALTRI ANTI AGGREGANTI	4

CCHR POSITIVA	**55/97**
CCHR NEGATIVA	**29/97**
CCHR N/A	**13/97**

Canadian CT Head Rule (CCHR)

- GCS<15 a due ore dall'evento traumatico;
- Sospetta frattura cranica aperta/depressa;
- Presenza di segni di frattura della base cranica (emotimpano, "Racoon eyes", "Battle Sign");
- ≥2 episodi di vomito;
- Amnesia retrograda > 30 minuti dall'evento;
- Dinamica violenta;
- Età > 65 anni.

Criteri di esclusione dalla CCHR: età < 16 anni, anticoagulanti in anamnesi, crisi tonico-cloniche dopo il trauma

RISULTATI

TC RADIOLOGO PS	TC POS	TC NEG	TOT
Test LIVELLI ELEVATI	13	54	67
Test LIVELLI NON ELEVATI	4	26	30
Tot	17	80	97

	TC PS	°BAZARIAN
SENSIBILITA'	76,47%	97,60%
SPECIFICITA'	32,50%	36,70%
VPP	11,18%	8,8%
VPN	93,25%	99,60%

Seconda opinione in cieco a Esperto Neuroradiologo su tutte le TAC

TC NEURORADIOLOGO	TC POS	TC NEG	TOT
Test LIVELLI ELEVATI	8	59	67
Test LIVELLI NON ELEVATI	0	30	30
Tot	8	89	97

	TC NEURORAD	BAZARIAN
SENSIBILITA'	100%	97,60%
SPECIFICITA'	33,71%	36,70%
VPP	14,35%	8,8%
VPN	100%	99,60%

Non concordanza radiologica nel 9 % dei casi

°Serum GFAP and UCH-L1 for prediction of absence of intracranial injuries on head CT (ALERT-TBI): a multicentre observational study.
Bazarian JJ et al. .Lancet Neurol. 2018 Sep;17(9):782-789. doi: 10.1016/S1474-4422(18)30231-X. Epub 2018 Jul 24.

TC CEREBRALE (SENZA CONTRASTO)

Si apprezza iperdensità lungo i seni trasversi e nel tentorio da rivalutare con TC a 6/12 ore.

IV ventricolo in asse, non dilatato.

Sistema ventricolare in asse non dilatato.

Ipodensità della sostanza bianca peri e sopraventricolare.

Regolari in ampiezza gli spazi spazi subaracnoidei della base e della convessità cerebrale.

Necessaria visita specialistica.

Integro il tavolato cranico. Piccolo ematoma a carico dei tessuti molli della regione parietale destra.

TC DEL CAPO - TC DELL' ENCEFALO

Esame confrontato ad analogo precedente del 23/02/2023 ore 20:49

In atto appare meno evidente, parafisiologica la segnalata iperdensità lungo i seni trasversi e nel tentorio. Invariata piccola lesione extradurale frontale sinistra di circa 1 cm con scalloping osseo associato, che giunge a contatto con la superficie corticale cerebrale che mostra tenue relativa iperdensità invariata rispetto al controllo, più verosimilmente calcifica, riferibile in prima ipotesi a meningioma. Utile approfondimento RM in elezione. IV ventricolo in asse, non dilatato.

Sistema ventricolare in asse non dilatato. Ipodensità della sostanza bianca peri e sopraventricolare.

Regolari in ampiezza gli spazi spazi subaracnoidei della base e della convessità cerebrale.

Necessaria visita specialistica. Integro il tavolato cranico. Piccolo ematoma a carico dei tessuti molli della regione parietale destra.

TC DEL CAPO - TC DELL' ENCEFALO
L'indagine è stata condotta in regime di urgenza in condizioni di base per trauma cranico.
Lo studio documenta esile stria di iperdensità in sede frontale paramediana sinistra, sospetta per focolaio emorragico extra-assiale: opportuno monitoraggio clinico e rivalutazione a 6 ore a meno di variazioni delle condizioni cliniche della Paziente.
Falda di ematoma subgaleale con spessore max di circa 4 mm in sede frontale sinistra.
Sistema ventricolare simmetrico, non dilatato.
In asse le strutture mediane.
Regolari gli spazi liquorali subaracnoidei della volta e le cisterne della base.

TC DEL CAPO - TC DELL' ENCEFALO
L'indagine è stata condotta in regime di urgenza in condizioni di base per controllo.
Allo studio odierno non appare più documentabile l'esile stria di iperdensità in sede frontale paramediana sinistra.
Permane falda di ematoma subgaleale con spessore max di circa 4 mm in sede frontale sinistra.
Sistema ventricolare simmetrico, non dilatato.
In asse le strutture mediane.
Regolari gli spazi liquorali subaracnoidei della volta e le cisterne della base.

TC DEL CAPO - TC DELL' ENCEFALO
L'indagine è stata condotta in regime di urgenza in condizioni di base.
Lo studio documenta sottile stria iperdensa (spessore max 3 mm circa) in sede frontale anteriore destra sospetta per focolaio emorragico extra-assiale: opportuno monitoraggio clinico e rivalutazione a distanza di 6 ore a meno di variazione delle condizioni cliniche del paziente.
Ematoma subgaleale in sede parieto-occipitale sinistra dello spessore massimo di circa 5,5 mm.
Sistema ventricolare simmetrico, non dilatato.
In asse le strutture mediane.
Regolari gli spazi liquorali subaracnoidei della volta e le cisterne della base.

TC DEL CAPO - TC DELL' ENCEFALO
L'indagine è stata condotta in regime di urgenza in condizioni di base.
Al controllo odierno, non più apprezzabile la stria iperdensa in sede frontale anteriore destra.
Ematoma subgaleale in sede parieto-occipitale sinistra dello spessore massimo di circa 7 mm.
Sistema ventricolare simmetrico, non dilatato.
In asse le strutture mediane.
Regolari gli spazi liquorali subaracnoidei della volta e le cisterne della base.

TC CEREBRALE (SENZA CONTRASTO)
Esame eseguito in regime d'urgenza nelle sole condizioni basali
Millimetrica immagine iperdensa extrassiale in sede frontale sinistra, da rivalutare a 6/12 ore.
Non ulteriori alterazioni densitometriche del tessuto encefalico a sede sopra e sottotentoriale , da riferire a lesioni ischemiche acute e/o focolai emorragici in atto.
Sistema ventricolare simmetrico non dilatato.
Regolare l'ampiezza degli spazi subarcnoidei della base e della convessità.
In asse le strutture della linea mediana.
TC DEL MASSICCIO FACCIALE
Rime fratturative a carico delle ossa proprie del naso lievemente scomposte.
Deviazione del setto nasale a destra con sperone osseo e con due rime fratturative scomposte. Lieve ispessimento della mucosa che riveste i turbinati inferiori. Liberi i seni mascellari, sfenoidali e frontali. Presenza di conca bullosa al turbinato medio di destra e di sinistra.
Necessaria visita specialistica
TC DEL RACHIDE CERVICALE
In atto non sono rilevabili lesioni ossee traumatiche recenti a carico dei metameri scheletrici esaminati In considerazione che alcune rime di frattura senza scomposizione dei frammenti risultano evidenziabili dopo qualche giorno, qualora dovesse persistere un'importante sintomatologia, si consiglia visita specialistica e approfondimento diagnostico.
TC DEL RACHIDE DORSALE
Infrazione a carico del processo spinoso di Th1.
Lievemente ridotti in altezza i somi di Th9, Th10, Th11, Th12 e L1 senza tuttavia segni da fratture recenti.

TC DEL CAPO - TC DELL' ENCEFALO

Esame eseguito in regime d'urgenza nelle condizioni di base in paziente con "trauma cranico post episodio lipotimico con flc occipitale".

Millimetrica iperdensità intraparenchimale di circa 5 mm di diametro in regione parietale sn a livello della sostanza bianca sovraventricolare meritevole di rivalutazione a 8 h circa in quanto compatibile con piccolo focolaio emorragico.

Non alterazioni tomodensitometriche in sede sovra e sottotentoriale da riferire a lesioni ischemiche recenti apprezzabili con la metodica .

Sfumata ipodensità a livello dei centri semiovali da ricondurre ad esiti vasculopatici cronici.

Sistema ventricolare simmetrico, non dilatato.

Spazi liquorali della volta e della base nei limiti.

In asse le strutture della linea mediana.

William K. Erly[1]
Boyd C. Ashdown[2]
Richard W. Lucio II[3]
Raymond F. Carmody[1]
Joachim F. Seeger[1]
Jennifer N. Alcala[1]

Evaluation of Emergency CT Scans of the Head: Is There a Community Standard?

Received May 8, 2002; accepted after revision November 22, 2002.

TABLE 1 False-Positive Findings in Emergency CT Scans of the Head That Reflected Significant Disagreement Between Initial and Final Interpretations

Interpretations	
Preliminary–Performed by General Radiologist	Final–Performed by Neuroradiologist
Subdural hematoma along tentorium	Normal results
Pneumocephalus	Negative results
Acute hemorrhagic infarction	Remote calcified infarction
Remote infarction	Postoperative changes
Skull fracture	No fracture

RESULTS. Agreement between the initial interpretation by the general radiologist and the final interpretation by the neuroradiologist was found in 95% of the CT scans. The interpretations were judged to show insignificant disagreement in 3% (23/716) of the scans and to show significant disagreement in 2% (16/716). Of the 16 significant errors, five were false-positive findings and 11 were false-negative findings. Forty-seven CT scans depicted significant or active disease, and in 11 (23%) of these scans, the final report differed significantly from the preliminary interpretation. Three patients had pituitary masses, none of which had been described on the preliminary interpretation.

Clinical Radiology (2008) 63, 791–795

The role of specialist neuroradiology second opinion reporting: is there added value?

G.M. Briggs[a,*], P.A. Flynn[c], M. Worthington[b], I. Rennie[c], C.S. McKinstry[c]

Departments of [a]Radiology, Craigavon Area Hospital, [b]Belfast City Hospital, and [c]Neuroradiology, Royal Victoria Hospital, Belfast, UK

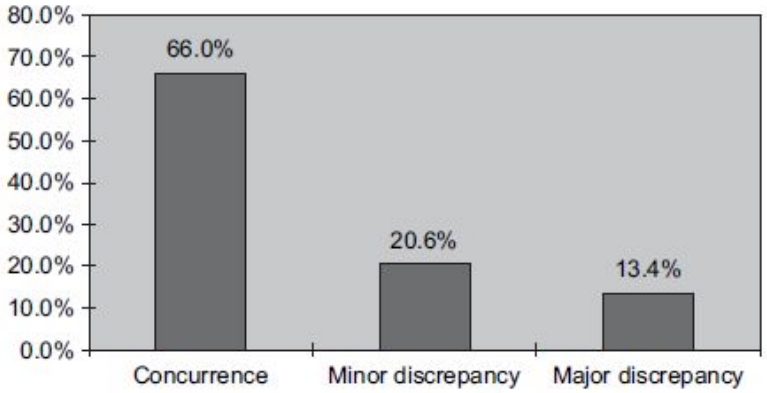

Figure 1 Overall discrepancy rates.

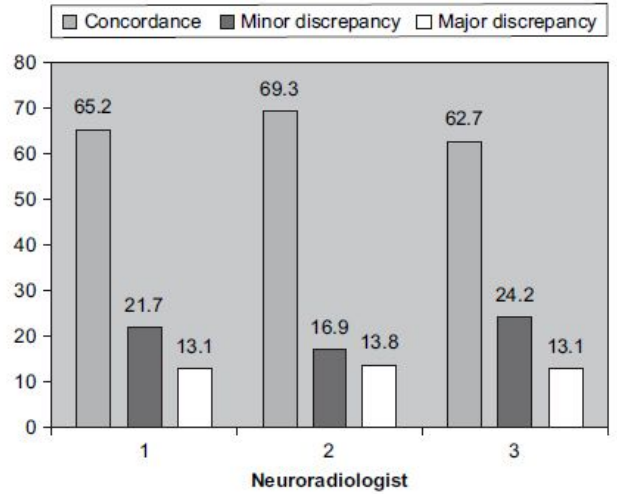

Figure 2 Concordance and discrepancy rate per neuroradiologists.

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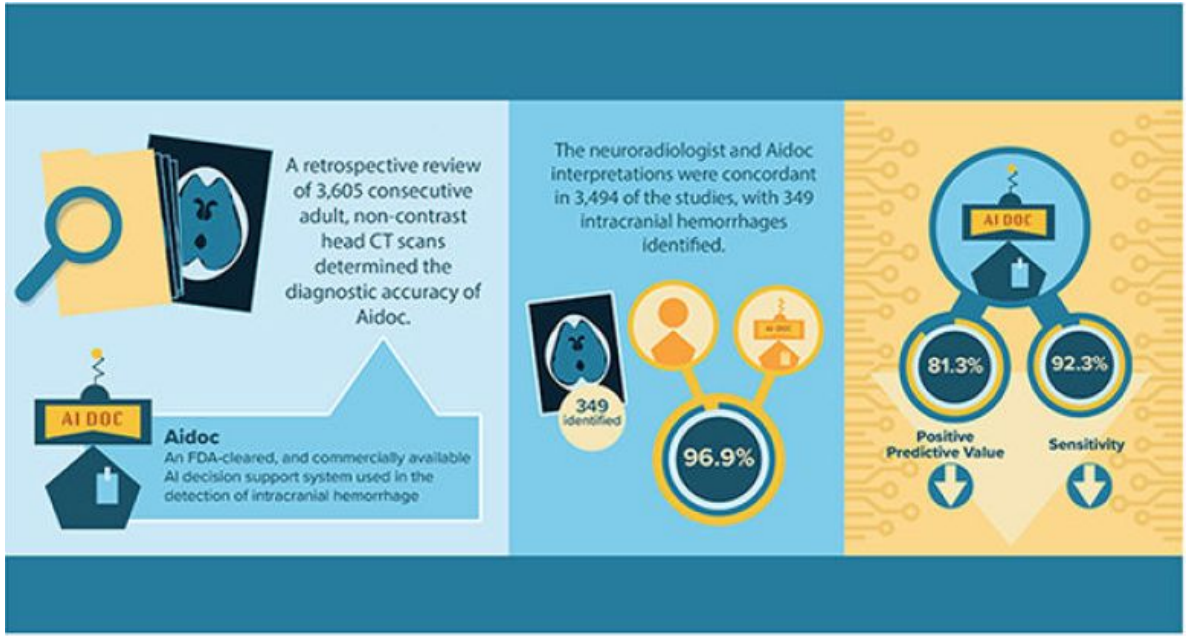
Diagnostic accuracy and failure mode analysis of a deep learning algorithm for the detection of intracranial hemorrhage

Andrew F. Voter, PhD[1], **Ece Meram, MD**[2], **John W. Garrett, PhD**[2], **John-Paul J. Yu, MD, PhD**[2,3,4,5]

[1]:School of Medicine and Public Health, University of Wisconsin-Madison, 600 Highland Avenue, Madison, WI 53692

Summary statement:

Unexpected lower sensitivity and positive predictive values were observed for an artificial intelligence decision support system for intracranial hemorrhage detection, raising concerns about the generalizability of deep learning tools.



RISULTATI

Canadian CT Head Rule (CCHR)
NEGATIVA: (29 pazienti su 97: 30%)

	CCHR	BAZARIAN
SENSIBILITA'	87	97,60%
SPECIFICITA'	35	36,70%
VPP	7	8,8%
VPN	98	99,60%

TC RADIOLOGO PS	TC POS	TC NEG	TOT
Test LIVELLI ELEVATI	13	54	67
Test LIVELLI NON ELEVATI	4	26	30
Tot	17	80	97

	TC PS	BAZARIAN
SENSIBILITA'	76,47%	97,60%
SPECIFICITA'	32,50%	36,70%
VPP	11,18%	8,8%
VPN	93,25%	99,60%

TC NEURORADIOLOGO	TC POS	TC NEG	TOT
Test LIVELLI ELEVATI	8	59	67
Test LIVELLI NON ELEVATI	0	30	30
Tot	8	89	97

	TC NEURORAD	BAZARIAN
SENSIBILITA'	100%	97,60%
SPECIFICITA'	33,71%	36,70%
VPP	14,35%	8,8%
VPN	100%	99,60%

Ananthaharan et al. BMC Emergency Medicine (2018) 18:44
https://doi.org/10.1186/s12873-018-0193-2

BMC Emergency Medicine

RESEARCH ARTICLE Open Access

Utility and effectiveness of the Scandinavian guidelines to exclude computerized tomography scanning in mild traumatic brain injury - a prospective cohort study

Arurann Ananthaharan[1,2*], Gunnhild Kravdal[3] and Truls Martin Straume-Naesheim[4,5]

Discussion

The implementation of the updated Scandinavian guidelines for acute management of adult patients with MTHI at the Emergency Department at AHUS resulted in 31.3% of the cases being discharged directly after the primary assessment without further observation or CT examinations. Correct use of S100B contributed to approximately 20% of the total number of discharges.

Conclusion

The implementation of the S100B and the updated SNC guidelines resulted in one third of the MTHI cases being discharged without further observation or CT examinations. One in five of these discharges was a direct result of S100B testing. However, almost half of the negative S100B results were ignored and in total the guidelines were not followed for nearly 40%. Nevertheless, no readmissions or missed severe traumatic injuries to the brain were observed.

31 % no TAC.

20% del tot grazie a S100B

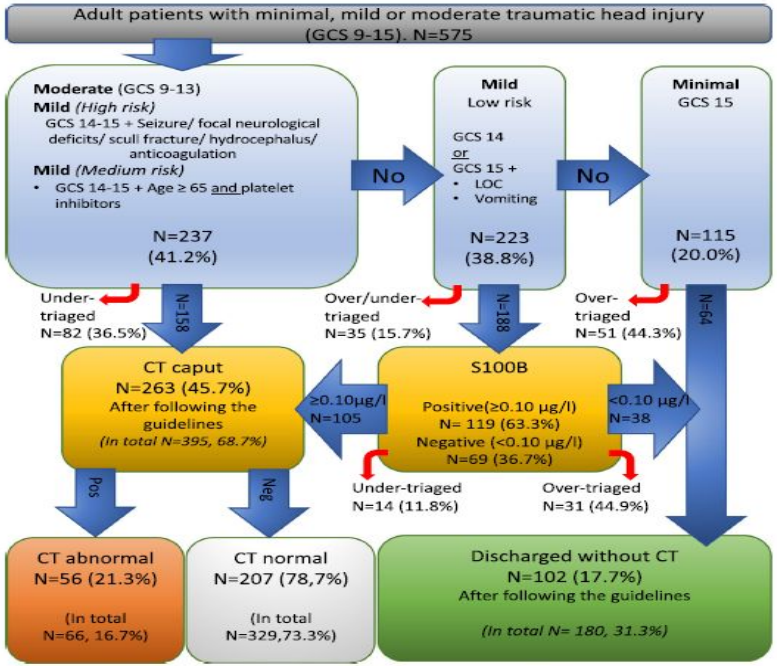


Fig. 2 Flowchart of the results from the first 6 months with the new guidelines at Akershus University Hospital. Red arrows: Failure to perform an indicated assessment according to the guidelines (undertriage) or an assessment performed outside the indicated guidelines (overtriage). All numbers marked «In total» refers to all patients including the cases where the guidelines were not followed

Nel 40% dei casi Linee Guida NON SEGUITE

Cureus

Open Access Original Article

DOI: 10.7759/cureus.35551

Prevalence of Computed Tomography Overuse for Mild Head Injury in Adults

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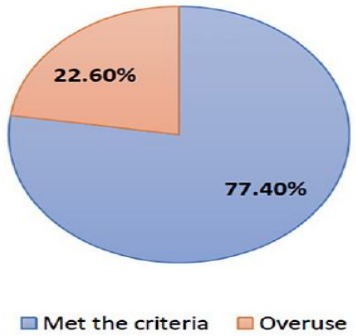

FIGURE 1: Overall percentages of CT scanning overuse.

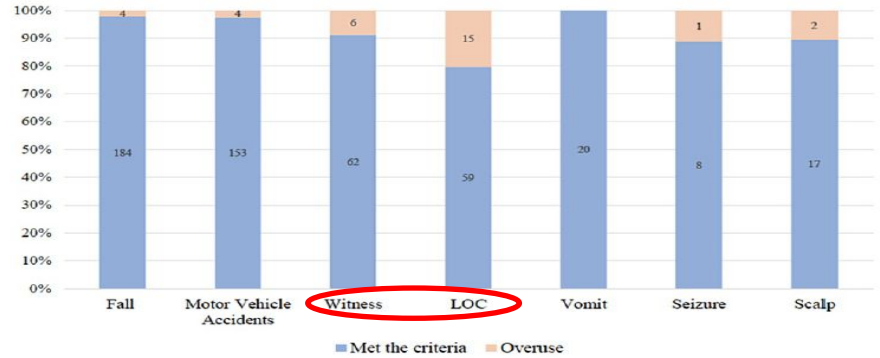

FIGURE 2: Frequencies of injuries and symptoms in meeting CT scan criteria.

LOC: loss of consciousness.

La radiologia medica (2018) 123:507–514
https://doi.org/10.1007/s11547-018-0871-x

COMPUTED TOMOGRAPHY

Overuse of computed tomography for minor head injury in young patients: an analysis of promoting factors

Michaela Cellina[1] · Marta Panzeri[2] · Chiara Floridi[1] · Carlo Maria Andrea Martinenghi[2] · Giulio Clesceri[1] · Giancarlo Oliva[1]

Received: 18 January 2018 / Accepted: 1 March 2018 / Published online: 7 March 2018

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Physicians specialty and seniority	Total requested CT scans	Inappropriate requests according to NICE	Inappropriate requests according to CCHR
Emergency physician	76	55/76	53/76
General surgeon	368	260/368	262/368
Orthopedic	0		
Neurosurgeon	19	16/19	16/19
Neurologist	23	19/23	19/23
Ophthalmologist	7	5/7	6/7
Experience < 5 years	25	17/25	18/25
Experience 5–10 years	53	35/53	37/53
Experience > 10 years	415	295/415	301/415

Sensitivity and specificity of CCHR and NICE

In our series, NICE showed sensitivity of 100%, specificity of 74%, accuracy of 74%, positive predictive value (PPV) of 7%, and negative predictive value (NPV) of 100%.

CCHR showed sensitivity of 100%, specificity of 72%, accuracy of 72%, PPV of 7%, and NPV of 100%.

At univariate analysis, we observed a significant correlation between abnormal CT scan, and well-evident head wound ($p < 0.001$), signs of suspected skull fracture ($p < 0.001$), hemotympanum ($p < 0.001$), panda/raccoon eyes ($p = 0.02$), trauma with high energy impact ($p < 0.001$), and sport injuries ($p = 0.01$). Multivariate analysis demonstrated that factors significantly associated with CT scan positivity included signs of suspected skull fracture ($p < 0.001$, OR 20.430, CI 2.727–153.052) and motor vehicle accident with high-energy impact ($p < 0.001$, OR 220.650, CI 33.123–1469.854).

Appropriateness according to the guidelines

A total of 493 CT scans were collected; 357 (72%) and 347 (70%) examinations were not indicated according to the CCHR and NICE, respectively.

European Journal of Trauma and Emergency Surgery (2023) 49:1189–1198
https://doi.org/10.1007/s00068-022-01902-5

ORIGINAL ARTICLE

Variability in the indication of brain CT scan after mild traumatic brain injury. A transnational survey

Alfonso Lagares[1,2] · Ana María Castaño-Leon[1] · Marlon Richard[3] · Parmenion Philip Tsitsopoulos[4] · Julian Morales[5] · Podaru Mihai[6] · Vladislav Pavlov[7] · Odile Mejan[8] · Javier de la Cruz[9] · Jean François Payen[3] · BRAINI Investigators

Received: 13 November 2021 / Accepted: 30 January 2022 / Published online: 18 February 2022

Table 1 Characteristics of 131 centers responding to the survey

	Spain (*n*, %)	France (*n*,%)	Greece (*n*, %)	Portugal	All
Hospital type					
Level 1 (few specialities, limited lab)	3 (4)	16 (45)	0	0	19 (15)
Level 2 (5–10 specialities)	22 (28)	17 (48)	2 (14)	1 (20)	42 (32)
Level 3 (all resources)	53 (68)	3 (7)	10 (86)	4 (60)	70 (54)
Public financing	74 (95)	31 (86)	12 (100)	5 (100)	122 (93)
Neurosurgeon available (24/7)	46 (59)	31 (86)	5 (42)	5 (100)	87 (66)
Trauma ICU on site	36 (46)	24 (67)	5 (42)	5 (100)	70 (53)
Technician to perform CT scan 24/7 on site	74 (95)	29 (81)	10 (83)	5 (100)	118 (90)
Who is responsible for the management of mild TBI					
Emergency medicine	81 (66)	38 (84)	2 (11)	2 (20)	125 (62)
Neurologist	2 (2)	0 (0)	0 (0)	0	3 (1)
Neurosurgery	25 (20)	3 (6)	11 (61)	3 (30)	43 (21)
Trauma surgeon	3 (2)	2 (4)	0 (0)	1 (10)	8 (4)
General surgeon	5 (4)	0 (0)	5 (28)	4 (40)	14 (7)
Intensivist	6 (4)	2 (4)	0 (0)	0	8 (4)
Observation area in the ER for mild TBI	74 (95)	34 (94)	9 (75)	4 (80)	121 (92)

More than one answer was allowed regarding especially responsible for mTBI management

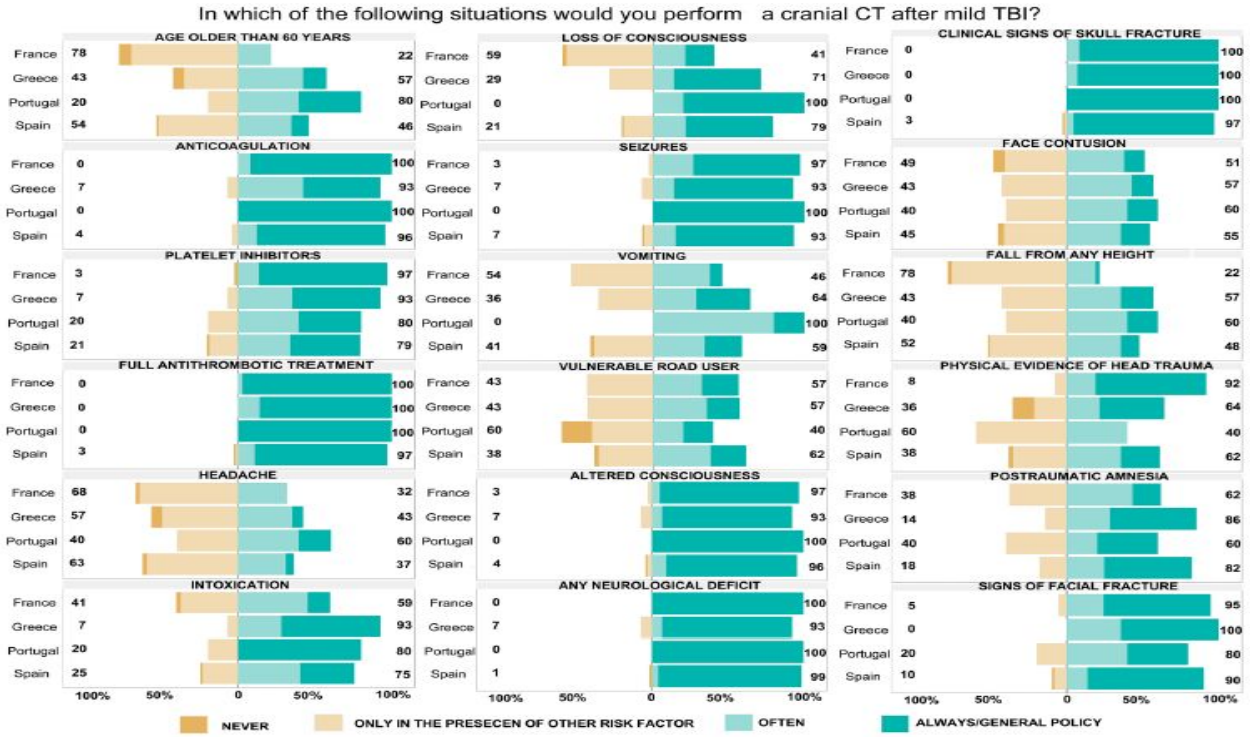

Fig. 2 Factors determining the use of cranial CT

CONCORDANZA

- Scoagulati
- Antiaggregati
- Vertigini
- GCS 14
- Deficit neurologici
- Fratture cranio-facciali

NON CONCORDANZA

- Età no in Francia
- Amnesia più sensibili Grecia e Spagna
- S100B in 5 centri Francia

CCHR Negativa (29 pazienti su 97) Risultati

TC PS			
	TC POS	TC NEG	TOT
Test LIVELLI ELEVATI	1	6	7
Test LIVELLI NON ELEVATI	4	18	22
Tot	5	24	29

TC 2nd OPINION NEURORADIOLOGO			
	TC POS	TC NEG	TOT
Test LIVELLI ELEVATI	0	7	7
Test LIVELLI NON ELEVATI	0	22	22
Tot	0	29	29

4 PAZIENTI CANADIAN NEGATIVI E TEST NEGATIVO HANNO «SUBITO» 2 TAC

22 PAZIENTI ERANO CANADIAN NEGATIVI E TEST NEGATIVO (TAC NON INDICATA)

In soldoni evitabile il 75% delle TAC Canadian Negativa

INFINE…

.

Test LIVELLI ELEVATI"	67
Test LIVELLI NON ELEVATI"	30
TC POSITIVE (NEURORADIOLOGO 2nd OPINION)	8
TC NEGATIVE (NEURORADIOLOGO 2nd OPINION)	89

59 PAZIENTI SU 97 HANNO UN TEST ELEVATO MA TAC NEGATIVA

JAMA Network Open

TRACK-TBI Transforming Research and Clinical Knowledge in Traumatic Brain Injury
International Traumatic Brain Injury Research Initiative

Original Investigation | Emergency Medicine

Outcomes in Patients With Mild Traumatic Brain Injury Without Acute Intracranial Traumatic Injury

Debbie Y. Madhok, MD; Robert M. Rodriguez, MD; Jason Barber, MS; Nancy R. Temkin, PhD; Amy J. Markowitz, JD; Natalie Kreitzer, MD; Geoffrey T. Manley, MD, PhD; for the TRACK-TBI Investigators

DESIGN, SETTING, AND PARTICIPANTS This cohort study analyzed participants who were enrolled from January 1, 2014, to December 31, 2018, in the Transforming Research and Clinical Knowledge in Traumatic Brain Injury (TRACK-TBI) study, a prospective, observational cohort study of patients with TBI that was conducted in EDs of 18 level I trauma centers in urban areas. Of the total 2697 participants in the TRACK-TBI study, 991 had a GCS score of 15 and negative head CT scan and were eligible for inclusion in this analysis. Data were analyzed from September 1, 2021, to May 30, 2022.

OBJECTIVE To describe the 2-week and 6-month recovery outcomes in a cohort of patients with mild TBI with a GCS score of 15 and a negative head CT scan.

Table 1. Baseline Characteristics of Participants and 6-Month Outcomes[a]

Variable	Overall, No. (%)[b]	6-mo GOS-E outcome				
		Recovery, No. (%)		Unfavorability		
		Incomplete: GOS-E score of 1-7	Functional: GOS-E score of 8	Risk, %	RR for incomplete recovery (95% CI)[c]	Unknown GOS-E score, No. (%)
All participants	991	372	287	56		332

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Susceptibility-Weighted MRI and Microbleeds in Mild Traumatic Brain Injury: Prediction of Posttraumatic Complaints?

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Background: Only in 7–15% of patients with mild traumatic brain injury (mTBI), traumatic CT-abnormalities are found. Nevertheless, 40% of mTBI patients suffer from posttraumatic complaints not resolving after 6 months. We discuss the ability of susceptibility-weighted imaging (SWI), sensitive for microbleeds, to detect more subtle brain abnormalities.

Summary: After a search on PubMed, we selected 15 studies on SWI in adult mTBI patients; 11 studies on 3T MRI, and 4 studies on 1.5T MRI. All 1.5T studies showed that, compared

Key Messages: There is some evidence that traumatic microbleeds predict cognitive outcome and persistent posttraumatic complaints in patients with mTBI.

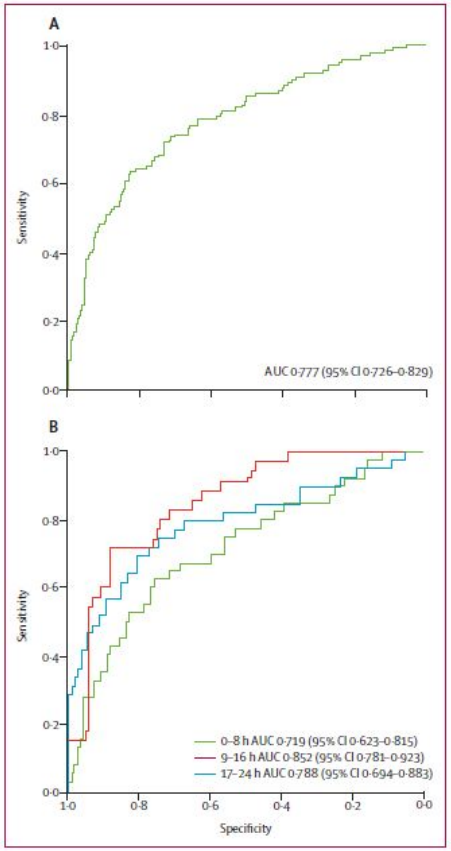

Figure 2: **Receiver operating characteristic curves for GFAP in patients with CT-negative and MRI-positive findings versus patients with CT-negative and MRI-negative findings within 24 h of injury (A) and by time of venepuncture post injury (B)**

(A) Plasma GFAP concentration using a point-of-care platform shows fair discrimination (AUC 0·777) between patients with MRI-positive findings and patients with MRI-negative findings in patients with CT-negative traumatic brain injury. (B) GFAP at 9–16 h post injury shows improved discrimination to good (AUC 0·852), suggesting temporal effects of GFAP release or accumulation in the systemic circulation after traumatic brain injury and time for optimal or repeat measurement. GFAP=glial fibrillary acidic protein. AUC=area under the curve.

Association between plasma GFAP concentrations and MRI abnormalities in patients with CT-negative traumatic brain injury in the TRACK-TBI cohort: a prospective multicentre study

Lancet Neurol 2019; 18: 953–61

John K Yue, Esther L Yuh*, Frederick K Korley*, Ethan A Winkler, Xiaoying Sun, Ross C Puffer, Hansen Deng, Winward Choy, Ankush Chandra, Sabrina R Taylor, Adam R Ferguson, J Russell Huie, Miri Rabinowitz, Ava M Puccio, Pratik Mukherjee, Mary J Vassar, Kevin K W Wang, Ramon Diaz-Arrastia, David O Okonkwo, Sonia Jain, Geoffrey T Manley, and the TRACK-TBI Investigators†*

	Number of patients	Plasma GFAP concentration (pg/mL)			p value
		Mean (SD)	Median (25–75th percentile)	Range	
Positive CT	199	1400·9 (1598·6)	786·0 (357·0–1863·3)	0–9409·7	<0·0001*
Negative CT	450	308·0 (530·5)	110·3 (22·7–352·3)	0–4095·1	..
Negative CT and positive MRI	120	692·2 (827·6)	414·4 (139·3–813·4)	5·2–4095·1	<0·0001†
Negative CT and negative MRI	330	168·3 (250·9)	74·0 (17·5–214·4)	0–1864·5	..
Orthopaedic trauma controls	122	23·7 (37·2)	13·1 (6·9–20·0)	0–216·8	<0·0001‡§
Healthy controls	209	11·0 (12·7)	8·0 (3·0–14·0)	0–98·0	<0·0001‡§

GFAP=glial fibrillary acidic protein. P values were calculated from the Wilcoxon rank sum test for the comparisons, which compares the distributions of the two groups. *Compared with patients with negative CT. †Compared with patients with negative CT and negative MRI findings. ‡Compared with patients with negative CT and positive MRI findings. §Compared with patients with negative CT and negative MRI findings.

Table 2: **Plasma GFAP concentrations by imaging modality and findings**

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Lancet Neurol 2022; 21: 792–802

Incremental prognostic value of acute serum biomarkers for functional outcome after traumatic brain injury (CENTER-TBI): an observational cohort study

Isabel R A Retel Helmrich, Endre Czeiter, Krisztina Amrein, András Büki, Hester F Lingsma, David K Menon, Stefania Mondello, Ewout W Steyerberg, Nicole von Steinbüchel, Kevin K W Wang, Lindsay Wilson, Haiyan Xu, Zhihui Yang, David van Klaveren, Andrew I R Maas, on behalf of the CENTER-TBI participants and investigators

Interpretation Serum biomarkers have incremental prognostic value for functional outcome after traumatic brain injury. Our findings support integration of biomarkers—particularly UCH-L1—in established prognostic models.

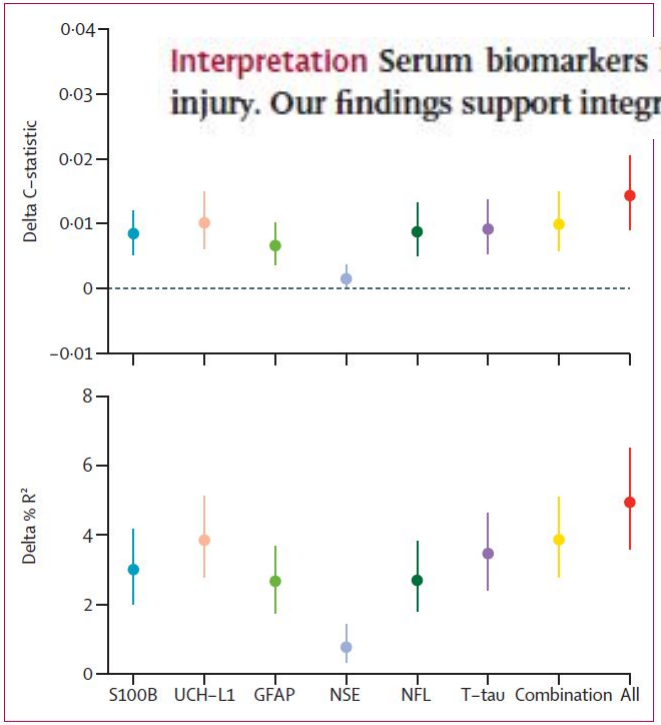

Figure 2: Incremental prognostic value of serum biomarkers to predict Glasgow Outcome Scale Extended score 6 months after injury

Reference model	0·922 (0·906–0·936)	51·0% (45·7–56·1)	0·883 (0·866–0·898)	49·7% (45·3–53·8)	0·802 (0·783–0·819)	33·8% (29·8–37·7)
Serum biomarkers‡						
S100B	0·009 (0·004–0·015)	3·3% (1·4–5·7)	0·008 (0·004–0·012)	2·4% (1·3–3·8)	0·007 (0·003–0·012)	1·6% (0·8–2·5)
UCH-L1	0·011 (0·005–0·017)	3·8% (2·1–5·9)	0·014 (0·009–0·021)	4·6% (3·0–6·5)	0·007 (0·003–0·012)	1·9% (1·1–3·0)
GFAP	0·006 (0·002–0·012)	2·3% (0·9–4·1)	0·010 (0·005–0·015)	3·0% (1·8–4·5)	0·003 (0·000–0·006)	1·0% (0·4–1·8)
NSE	0·004 (0·001–0·009)	1·6% (0·4–3·3)	0·003 (0·001–0·007)	1·1% (0·3–2·1)	0·001 (0·000–0·002)	0·2% (0·1–0·5)
NFL	0·005 (0·001–0·009)	1·5% (0·3–3·0)	0·015 (0·009–0·022)	4·2% (2·9–5·9)	0·007 (0·003–0·013)	1·8% (0·9–3·0)
T-tau	0·011 (0·005–0·017)	3·9% (2·0–6·2)	0·013 (0·008–0·019)	4·2% (2·6–5·9)	0·006 (0·002–0·011)	1·7% (0·9–2·7)
GFAP + UCH-L1	0·011 (0·006–0·018)	4·1% (2·2–6·2)	0·014 (0·008–0·020)	4·5% (2·9–6·3)	0·006 (0·002–0·012)	1·8% (0·9–2·9)
All	0·012 (0·005–0·019)	4·3% (1·9–6·9)	0·019 (0·012–0·027)	5·6% (3·7–7·7)	0·010 (0·004–0·018)	2·5% (1·2–4·1)

Data in parentheses are 95% CI. S100B=S100 calcium-binding protein B. UCH-L1=ubiquitin C-terminal hydrolase L1. GFAP=glial fibrillary acidic protein. NSE=neuron-specific enolase. NFL=neurofilament protein-light. T-tau=total tau. GOSE=Glasgow outcome scale extended. *GOSE ≤4. †GOSE <8. ‡Data for serum biomarkers are delta C-statistic or delta R^2.

Table 2: Discriminative ability (C-statistic) and R^2 of serum biomarkers adjusted for demographic, clinical, and radiology parameters to predict functional outcome 6 months after traumatic brain injury by clinically relevant thresholds

Open access Protocol

BMJ Open

Study protocol for investigating the clinical performance of an automated blood test for glial fibrillary acidic protein and ubiquitin carboxy-terminal hydrolase L1 blood concentrations in elderly patients with mild traumatic BRAIN Injury and reference values (BRAINI-2 Elderly European study): a prospective multicentre observational study

Alfonso Lagares,[1,2,3] Jean-François Payen,[4,5] Peter Biberthaler,[6] M Antonia Poca,[7] Odile Méjan,[8] Vladislav Pavlov,[9] Damien Viglino,[10,11] Vincent Sapin,[12] Aurora Lassaletta,[13] Javier de la Cruz,[14] Braini2_elderly_investigators Collaborative group[15]

To cite: Lagares A, Payen J-F, Biberthaler P, *et al*. Study protocol for investigating the clinical performance of

ABSTRACT

Introduction Two blood brain-derived biomarkers, glial fibrillar acidic protein (GFAP) and ubiquitin carboxy-terminal hydrolase L1 (UCH-L1), can rule out intracranial lesions in patients with mild traumatic brain injury (mTBI) when assessed within the first 12 hours. Most elderly patients were excluded from previous studies due to comorbidities. Biomarker use in elderly population could be affected by increased basal levels. This study will assess the performance of an automated test for measuring serum GFAP and UCH-L1 in elderly patients to predict the absence of intracranial lesions on head CT scans after mTBI, and determine both biomarkers reference values in a non-TBI elderly population.

Methods and analysis This is a prospective multicentre observational study on elderly patients (≥65 years) that will be performed in Spain, France and Germany. Two patient groups will be included in two independent substudies. (1) A cohort of 2370 elderly patients (1185<80 years and 1185≥80 years; BRAINI2-ELDERLY DIAGNOSTIC AND PROGNOSTIC STUDY) with mTBI and a brain CT scan that will undergo blood sampling within 12 hours after mTBI. The primary outcome measure is the diagnostic performance of GFAP and UCH-L1 measured using an automated assay for discriminating between patients with positive and negative findings on brain CT scans. Secondary outcome measures include the performance of both biomarkers in predicting early (1 week) and midterm (3 months) neurological status and quality of life after trauma. (2) A cohort of 480 elderly reference participants (BRAINI2-ELDERLY REFERENCE STUDY) in whom reference values for GFAP and UCHL1 will be determined.

Implicazioni nella Gestione del Trauma Cranico Lieve: Considerazioni sull'impatto degli Operatori nei Processi

COMPETENZA
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Test GFAP / UCH_L1

- **Sembra Ridurre la inappropriatezza**
- **Sembra ridurre i tempi di permanenza**
- **Forse stratifica il rischio a medio termine**
- **Rassicura l'Operatore, forse**

Why Not?