そのASDH、手術？保存？

山田　大輔

今日の構成

①現在のASDHの手術のindication

②血腫増大の予測因子

③indicationの再検討

今日の構成

①現在のASDHの手術のindication

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③indicationの再検討

Predictors of Functional Outcome After Subdural Hematoma: A Prospective Study

Jonathan M. Weimer[1] · Errol Gordon[2] · Jennifer A. Frontera[1]

Abstract

Background Although the incidence of subdural hematoma (SDH) has increased in the US in the last decade, limited prospective data exist examining risk factors for poor outcome.

Methods A prospective, observational study of consecutive SDH patients was conducted from 7/2008 to 11/2011. Baseline clinical data, hospital and surgical course, complications, and imaging data were compared between those with good versus poor 3-month outcomes (modified Rankin Scores [mRS] 0–3 vs. 4–6). A multivariable logistic regression model was constructed to identify independent predictors of poor outcome.

Results 116 SDH patients (18 acute, 56 mixed acute/subacute/chronic, 42 subacute/chronic) were included. At 3 months, 61 (53 %) patients had good outcomes (mRS 0–3) while 55 (47 %) were severely disabled or dead (mRS 4–6). Of those who underwent surgical evacuation, 54/94 (57 %) had good outcomes compared to 7/22 (32 %) who did not ($p = 0.030$). Patients with mixed acuity or subacute/chronic SDH had significantly better 3-month mRS with surgery (median mRS 1 versus 5 without surgery, $p = 0.002$) compared to those with only acute SDH ($p = 0.494$). In multivariable analysis, premorbid mRS, age, admission Glasgow Coma Score, history of smoking, and fever were independent predictors of poor 3-month outcome (all $p < 0.05$; area under the curve 0.90), while SDH evacuation tended to improve outcomes (adjusted OR 3.90, 95 % CI 0.96–18.9, $p = 0.057$).

Conclusions Nearly 50 % of SDH patients were dead or moderate-severely disabled at 3 months. Older age, poor baseline, poor admission neurological status, history of smoking, and fever during hospitalization predicted poor outcomes, while surgical evacuation was associated with improved outcomes among those with mixed acuity or chronic/subacute SDH.

Keywords Subdural hematoma · SDH · Outcome · Risk · Neurosurgery

Introduction

Subdural hematoma (SDH) represents a common form of intracranial bleeding that is increasing in prevalence and cost across the US [1]. The mortality rates associated with SDH range from 30 to 50 % depending on the acuity of the blood and patient comorbidities [2–6]. Between 1993 and 2007, nationwide, the number of hospital admissions and

- ASDHは死亡率の高い疾患である

Neurocrit Care. 2017 Feb;26(1):70-79

SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

RECOMMENDATIONS

(see *Methodology*)

Indications for Surgery

- An acute subdural hematoma (SDH) with a thickness greater than 10 mm *or* a midline shift greater than 5 mm on computed tomographic (CT) scan should be surgically evacuated, regardless of the patient's Glasgow Coma Scale (GCS) score.
- All patients with acute SDH in coma (GCS score less than 9) should undergo intracranial pressure (ICP) monitoring.
- A comatose patient (GCS score less than 9) with an SDH less than 10-mm thick and a midline shift less than 5 mm should undergo surgical evacuation of the lesion if the GCS score decreased between the time of injury and hospital admission by 2 or more points on the GCS and/or the patient presents with asymmetric or fixed and dilated pupils and/or the ICP exceeds 20 mm Hg.

Timing

- In patients with acute SDH and indications for surgery, surgical evacuation should be performed as soon as possible.

Methods

- If surgical evacuation of an acute SDH in a comatose patient (GCS < 9) is indicated, it should be performed using a craniotomy with or without bone flap removal and duraplasty.

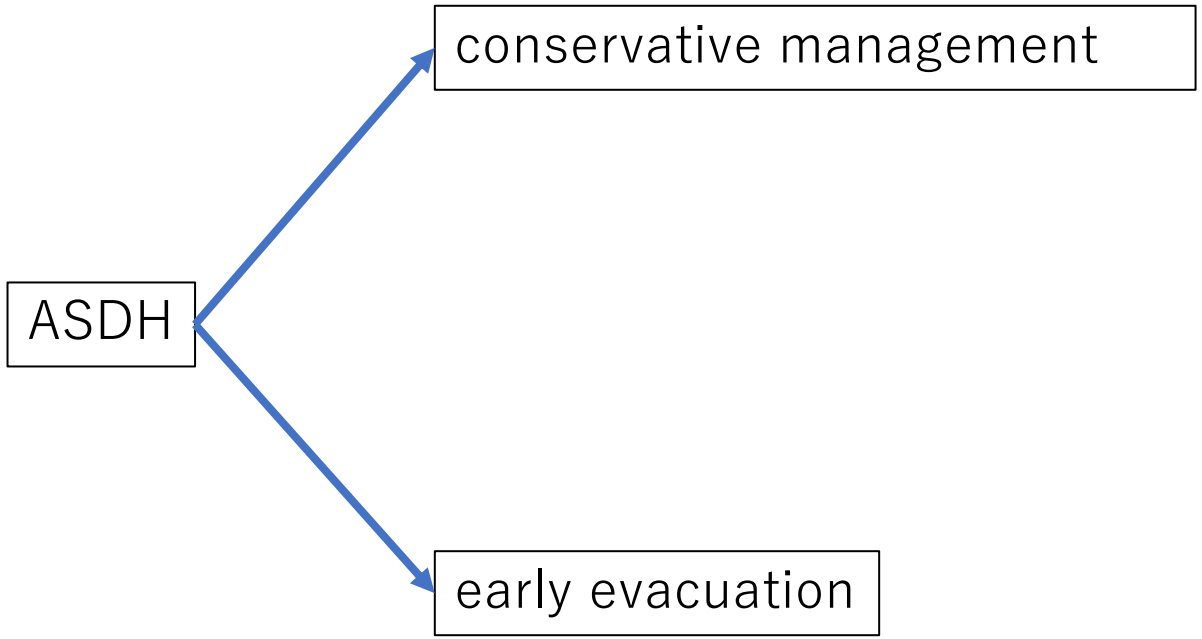
KEY WORDS: Coma, Computed tomographic parameters, Craniotomy, Decompressive craniectomy, Head injury, Hematoma, Intracranial pressure monitoring, Salvageability, Subdural, Surgical technique, Timing of surgery, Traumatic brain injury

Neurosurgery 58:S2-16-S2-24, 2006 DOI: 10.1227/01.NEU.0000210364.29290.C9 www.neurosurgery-online.com

①血腫＞10mm or ②midline shift＞5mm

上記を全て満たす症例においては
意識レベルに関わらず手術が必要とされている

Neurosurgery. 2006 Mar;58(3 Suppl):S16-24



- SDH thickness
- midline shift

Factors Associated with Early versus Delayed Expansion of Acute Subdural Hematomas Initially Managed Conservatively

Introduction

SUBDURAL HEMATOMAS (SDH) are becoming increasingly common and are associated with significant morbidity and mortality.[1] Acute SDHs (ASDHs) represent the most morbid form of SDHs. The mortality rate for ASDHs approaches 60% in comatose patients, and many survivors will go on to have significant functional disability.[2] Surgical decompression is necessary in some patients with ASDH[3]; however, almost 70% of patients are managed without surgery.[4] Non-surgical management is particularly important for the rising population of frail, elderly patients presenting with ASDHs,[5] as it allows many patients to either avoid surgery entirely or undergo a smaller surgery in a delayed fashion.[6]

One concern with conservative management is the risk of ASDH expansion, which has been blamed in part for the association between ASDH and the "talk and die" phenomenon.[7] Prior studies have identified risk factors of the expansion of conservatively managed ASDHs.[8–10] These studies are limited in the sense that they define expansion as need for delayed surgery, despite the fact that many expanding SDHs can be managed conservatively with close observation or medical therapy.[11] Several studies have also grouped all cases of SDH expansion together, regardless of when it occurs.[4] This is problematic, as ASDHs are known to evolve, with different mechanisms likely to account for expansion over time.[12] Specifically, membranes begin to form around the hematoma at approximately 72 h,[13] and these membranes are thought to drive most subsequent pathology.[14]

A better understanding of the risk factors for ASDH expansion and how these factors change over time could help guide decisions regarding follow-up imaging and perhaps even reduce the incidence of this complication. We hypothesized that early and delayed expansion are fundamentally different phenomena, and thus are likely to have different associated factors. To evaluate this, we examined factors associated with ASDH expansion in the early

- しかし，保存的加療を行うことで，血腫がより増大する危険性もある

J Neurotrauma. 2021 Apr 1;38(7):903-910.

SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

RECOMMENDATIONS

(see *Methodology*)

Indications for Surgery

- An acute subdural hematoma (SDH) with a thickness greater than 10 mm *or* a midline shift greater than 5 mm on computed tomographic (CT) scan should be surgically evacuated, regardless of the patient's Glasgow Coma Scale (GCS) score.
- All patients with acute SDH in coma (GCS score less than 9) should undergo intracranial pressure (ICP) monitoring.
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Timing

- In patients with acute SDH and indications for surgery, surgical evacuation should be performed as soon as possible.

Methods

- If surgical evacuation of an acute SDH in a comatose patient (GCS $<$ 9) is indicated, it should be performed using a craniotomy with or without bone flap removal and duraplasty.

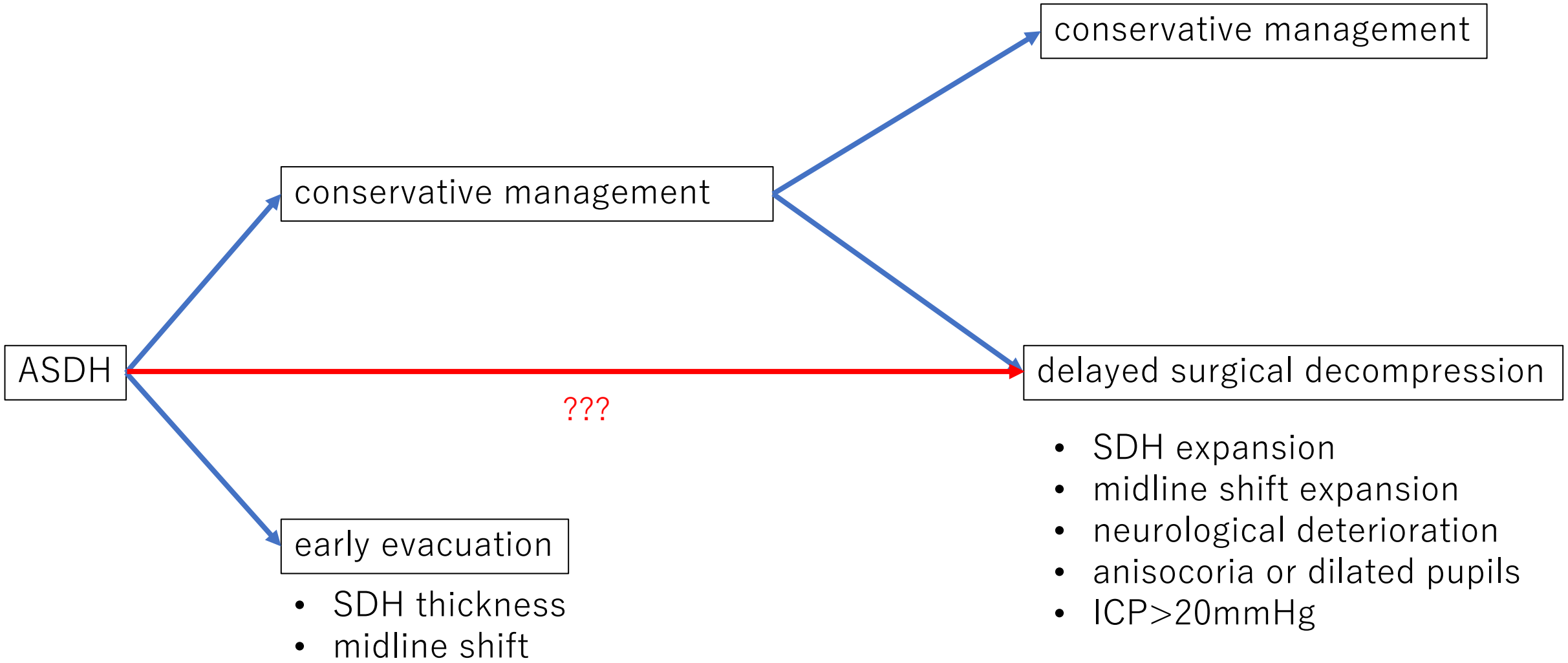
KEY WORDS: Coma, Computed tomographic parameters, Craniotomy, Decompressive craniectomy, Head injury, Hematoma, Intracranial pressure monitoring, Salvageability, Subdural, Surgical technique, Timing of surgery, Traumatic brain injury

Neurosurgery 58:S2-16-S2-24, 2006 DOI: 10.1227/01.NEU.0000210364.29290.C9 www.neurosurgery-online.com

緊急手術を行わなかったGCS<9の症例において
下記のいずれかが見られた場合血腫除去が推奨される

①2点以上GCSが低下
②瞳孔不同もしくは瞳孔散大
③ICP>20mmHg

Neurosurgery. 2006 Mar;58(3 Suppl):S16-24


conservative management
conservative management
ASDH
delayed surgical decompression
???
early evacuation
• SDH thickness
• midline shift
• SDH expansion
• midline shift expansion
• neurological deterioration
• anisocoria or dilated pupils
• ICP>20mmHg

今日の構成

①現在のASDHの手術のindication

②血腫増大の予測因子

③indicationの再検討

Factors Associated with Early versus Delayed Expansion of Acute Subdural Hematomas Initially Managed Conservatively

David Robinson,[1] Logan Pyle,[1] Brandon Foreman,[1,2] Laura B. Ngwenya,[2,3] Opeolu Adeoye,[3,4] Daniel Woo,[1] and Natalie Kreitzer[4]

- retrospective
- 単一施設
- 2018年にLevel 1の外傷センターに搬送
- 緊急手術になった症例は除く
- early群：受傷後72時間以内に血腫の画像followあり
- case：直近のCTと比較し、20%以上の血腫量もしくは厚さの増大
- control：血腫の増大がない
- 抗血小板薬・抗凝固薬とも適応があれば拮抗薬を使用

Table 1. Comparison of Baseline Factors between Early and Delayed Follow-Up Cohorts

	Early cohort (n = *305*)	*Delayed cohort* (n = *167*)	P-*value*
Age	67.1 (48.4, 79.9)	69.6 (50.7, 81.7)	0.35
Male	198 (65)	113 (68)	0.62
White	253 (83)	140 (84)	0.91
Dementia	47 (15)	24 (14)	0.87
Diabetes	60 (20)	38 (23)	0.5
Cirrhosis	8 (3)	4 (2)	1
Chronic kidney disease	22 (7)	27 (16)	0.71
Prior stroke	44 (14)	1 (1)	0.8
Prior traumatic brain injury	4 (1)	99 (59)	0.48
Hypertension	169 (55)	42 (25)	0.61
Coronary artery disease	69 (23)	20 (12)	1
Alcohol abuse[a]	36 (12)	19 (11)	0.4
Initial GCS score	15 (13, 15)	15 (13, 15)	0.76
White blood cell count (x10^9/L)	*N* = 301[c]; 9.8 (7.5, 13.9)	*N* = 165[c]; 10.5 (7.7, 15.2)	0.23
Hemoglobin (g/dL)	*N* = 302[c]; 13.4 (12, 14.6)	*N* = 166[c]; 13.6 (12, 14.5)	0.99
Sodium (mEq/L)	*N* = 301[c]; 139 (137, 142)	139 (136, 142)	0.35
Creatinine (mg/dL)	*N* = 300[c]; 0.9 (0.8, 1.1)	N = 166[c]; 0.94 (0.77, 1.18)	0.64
Fall as mechanism of injury[b]	177 (58)	101 (61)	0.85
No definite trauma history	13 (4)	5 (3)	0.66
Volume of SDH (mL)	*N* = 225[c]; 7 (2.3, 27.5)	N = 130[c]; 8.05 (3.1, 21.8)	0.84
SDH thickness (mm)	5 (3.4, 8)	5 (3.9, 8)	0.35
Midline shift (mm)	0 (0, 0)	0 (0, 0)	0.55
Other intracranial traumatic lesions	172 (56)	103 (62)	0.31
Pre-morbid anticoagulant use	45 (15)	30 (18)	0.44
Pre-morbid antiplatelet use	105 (34)	68 (41)	0.21
Modified Rankin Scale >2 at discharge	192 (63)	110 (66)	0.6

Data are *n* (%) or median (interquartile range).

[a]Defined as ≥3 drinks/day; [b]only ground-level or falls ≤3 ft were included in this category; [c]if missing values are present, the number of patients with full data (*N* =) is listed.

GCS, Glasgow Coma Scale; SDH, subdural hematoma.

no expansion: 78%

expansion: 22%

early expansion

median: 7h

Coagulopathy
①INR>1.3
②Plate<100,000

no or minimal trauma
①立った状態
②約90cmの高さ
からの転倒・落下

TABLE 2. FACTORS ASSOCIATED WITH EARLY EXPANSION

	No early expansion (n=237)	*Early expansion (n=68)*	*Univariable p-value*	*Univariable OR (95% CI)*	*Multi-variable p-value*	*aOR (95% CI)*
Age (years)	67.8 (51.3, 80.1)	61.95 (44.5, 77)	0.42	0.99 (0.98-1.01)	0.34	1.01 (0.99-1.03) per 10 years
Male	154 (65)	44 (65)	0.97	0.99 (0.6-1.8)		
Dementia	37 (16)	10 (15)	0.86	0.9 (0.4-1.9)		
Prior stroke	32 (14)	12 (18)	0.4	1.4 (0.6-2.8)		
Hypertension	136 (57)	33 (49)	0.2	0.7 (0.4-1.2)		
Alcohol abuse[a]	29 (12)	7 (10)	0.7	0.8 (0.3-1.9)		
Chronic kidney disease	23 (10)	3 (4)	0.18	0.4 (0.1-1.3)		
Initial GCS score	15 (14, 15)	13.5 (10, 15)	0.0002	0.9 (0.8-0.93)		
Initial SBP	140 (122, 159)	144.5 (125, 160)	0.17	1.01 (1-1.02)		
Initial SBP >160	54 (23)	17 (25)	0.7	1.1 (0.6-2.1)		
Initial creatinine (mg/dL)	N=232[d]; 0.95 (0.8, 1.1)	0.9 (0.8, 1.1)	0.7	0.9 (0.6-1.1)		
Coagulopathy[b]	**N = 223[d]; 48 (22)**	**N = 66[d]; 23 (35)**	**0.03**	**1.9 (1.06-3.5)**	**0.02**	**2.3 (1.2-4.5)**
No or minimal trauma[c]	**154 (65)**	**36 (53)**	**0.07**	**0.6 (0.4-1.1)**	**0.03**	**0.4 (0.2-0.9)**
Maximum SDH thickness (mm)	**4.8 (3.1, 7)**	**5.8 (4, 10)**	**0.03**	**1.1 (1-1.13)**	**0.006**	**1.1 (1.03-1.2) per 1 mm**
Midline shift (mm)	0 (0, 0)	0 (0,3)	0.1	1.1 (0.98-1.2)		
Convexity location	169 (71)	56 (82)	0.8	1.1 (0.6-1.8)		
Other intracranial lesions	**121 (51)**	**51 (75)**	**0.0006**	**2.9 (1.6-5.4)**	**0.002**	**3 (1.6-6.2)**
Epidural	4 (2)	4 (6)				
Contusion	56 (24)	24 (35)				
Subarachnoid hemorrhage	88 (32)	43 (63)				
Skull fracture	63 (23)	29 (42)				
Anticoagulant use	34 (14)	11 (16)	0.71	1.2 (0.5-2.4)		
Antiplatelet use	86 (36)	19 (28)	0.2	0.7 (0.4-1.2)		
Injury to initial scan (h)	**2 (1, 4)**	**1.5 (1, 2)**	**0.04**	**0.9 (0.8-0.97)**	**0.04**	**0.9 (0.8-0.97)**

Data are *n* (%) or median (interquartile range). Statistically significant variables on multi-variable analysis are bolded.
[a]Defined as ≥3 drinks/day; [b]defined as international normalized ratio (INR) >1.3 or platelets <100,000; [c]defined as no clear trauma or falls from ≤3 ft; [d]if missing values are present, the number of patients with full data (*N*=) is listed. No variables with >5% missing values were considered for the model.
aOR, adjusted odds ratio; CI, confidence interval; GCS, Glasgow Coma Scale; OR, odds ratio; SBP, systolic blood pressure; SDH, subdural hematoma.

TABLE 4. CLINICAL SIGNIFICANCE OF HEMATOMA EXPANSION IN EARLY AND LATE COHORTS

	Early expansion (n=68)	*Delayed expansion (n=41)*
Symptomatic expansion[a]	20 (29)	15 (37)
Severe symptomatic expansion[b]	13 (19)	3 (7)
Intervention required	28 (41)	23 (56)
Delay of antithrombotic resumption	0	6 (15)
Escalation in level of care[c]	21 (31)	6 (15)
Neurosurgery	7 (10)	8 (20)
Craniotomy	1 (1)	6 (15)
Hemicraniectomy	5 (7)	0
Burr hole	0	2 (5)
ICP monitor	1 (1)	0
Duration between injury and surgery	8.5 h (7-9 h)	14 days (10-16 days)
Steroid treatment	0	3 (7)

Data are *n* (%) or median (interquartile range).

[a]Using common data element definition of neuroworsening[24]; [b]defined as symptoms severe enough to prompt emergent surgery or withdrawal of life-sustaining treatment; [c]included transition from observation or ambulatory management to hospitalization or escalation to intensive care unit level of care for patients already admitted.

ICP, intracranial pressure.

Result

- early expansion

①凝固障害の有無　②外傷機転
③血腫の厚さ　④その他の頭蓋内の外傷　⑤画像確認までの時間
→手術を行なった症例：2.3％

Contrast Extravasation on CT Angiography Predicts Hematoma Expansion and Mortality in Acute Traumatic Subdural Hemorrhage

J.M. Romero, H.R. Kelly, J.E. Delgado Almandoz, J. Hernandez-Siman, J.C. Passanese, M.H. Lev, and R.G. González

- retrospective、単一施設
- 2000/1/1-2009/1/31の間に入院となったASDH症例
- inclusion:①18歳以上、②入院時に頚部顔面造影CTで評価している
- ③48時間以内に単純CTで再評価されている
- exclusion:①単純CT撮影前に死亡した症例　②血腫が1mm以下
- outcome:血腫の増大の有無(axialで20％以上)

extravasationの定義
①ASDH内の造影剤のpooling　②CT値＞120HU
③血管との連続性がない　④形や大きさは問わない

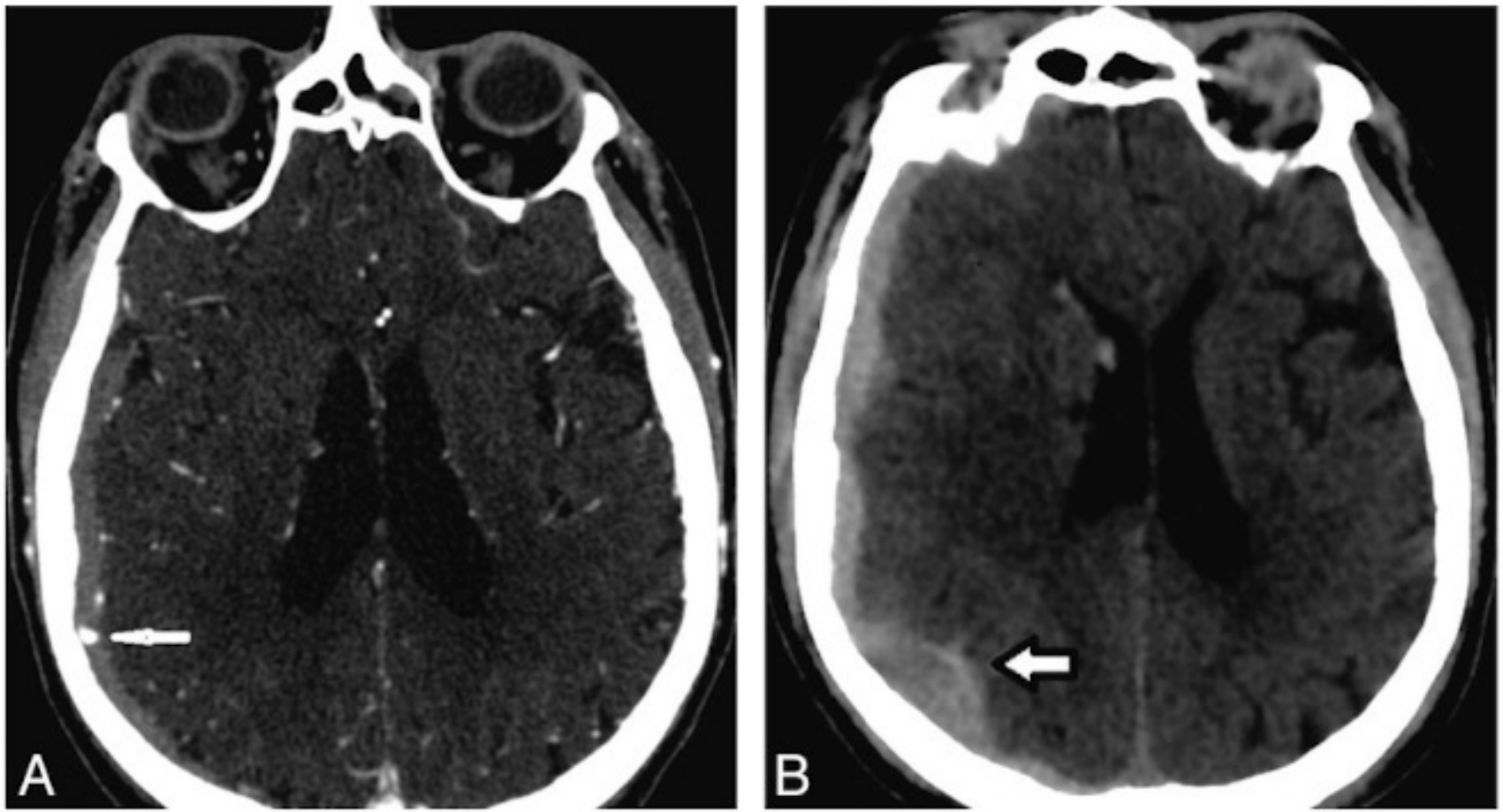


FIG 2. CT images of a 75-year-old man with blunt craniocervical trauma related to a motor vehicle crash. *A*, Axial source image from the CTA of the head in the emergency department demonstrates contrast extravasation *(arrow)* in the right hemispheric aSDH. *B*, Follow-up axial NCCT of the head at approximately the same level (obtained 4 hours later) demonstrates an increase of >20% of the aSDH thickness *(arrow)*.

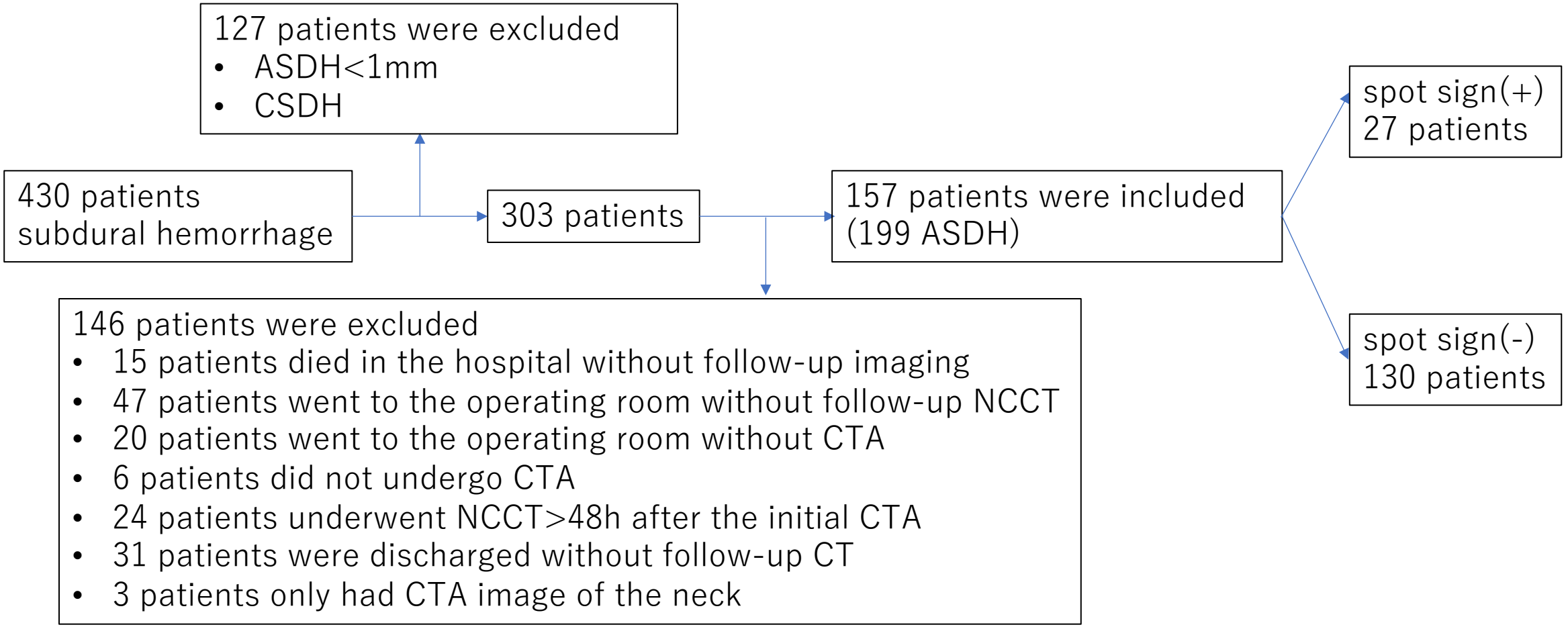

127 patients were excluded
• ASDH<1mm
• CSDH
430 patients
subdural hemorrhage
303 patients
157 patients were included
(199 ASDH)
spot sign(+)
27 patients
spot sign(-)
130 patients
146 patients were excluded
• 15 patients died in the hospital without follow-up imaging
• 47 patients went to the operating room without follow-up NCCT
• 20 patients went to the operating room without CTA
• 6 patients did not undergo CTA
• 24 patients underwent NCCT>48h after the initial CTA
• 31 patients were discharged without follow-up CT
• 3 patients only had CTA image of the neck

Table 1: Baseline clinical and radiologic characteristics

Characteristic	
Mean age, years (SD)	52 (22.5)
Sex	
Male (%)	117 (75)
Female (%)	40 (25)
Mean admission blood pressure, mm Hg	
Systolic (SD)	140.7 (26.8)
Diastolic (SD)	76.4 (14.8)
Mean admission GCS (SD)	11.58 (4.17)
History of hypertension (%)	46 (29)
Mean admission platelet count (SD)	244 (71)
Mean admission INR (SD)	1.24 (0.53)
Mean admission aPTT (SD)	25.70 (5.33)
Altered coagulation (%)	9 (6)
Antiplatelet therapy (%)	24 (15)
Mechanism of injury	
Fall from standing (%)	84 (54)
Fall from height (%)	18 (12)
Motor vehicle crash (%)	24 (15)
Pedestrian struck (%)	16 (10)
Direct blunt trauma (%)	13 (8)
Penetrating trauma (%)	2 (1)
aSDH location	
Frontal (%)	99 (50)
Temporal (%)	38 (19)
Parietal (%)	31 (16)
Parafalcine (%)	15 (8)
Occipital (%)	13 (6)
Cerebellar (%)	3 (1)
Mean initial maximum aSDH width, mm (SD)	6.0 (3.5)
Mean initial maximum midline shift, mm (SD)	2.2 (2.9)
Mean time to follow-up NCCT, hours (SD)	11.76 (7.98)

Table 2: Comparison of baseline characteristics between patients with and without spot sign

Characteristic	Spot Sign (*n* = 27)	No Spot Sign (*n* = 130)	*P* Value
Mean age, years (SD)	59 (22.2)	50 (22.4)	.07[a]
Sex (%)			.22[b+]
Male	23 (85)	94 (72)	
Female	4 (15)	36 (28)	
Admission blood pressure, mm Hg			
Systolic (SD)	144.4 (30.5)	140.0 (26.1)	.50[a]
Diastolic (SD)	76.7 (15.9)	76.4 (14.7)	.93[a]
Mean admission GCS (SD)	10.2 (4.3)	11.8 (4.1)	.09[c]
History of hypertension (%)	13 (48)	33 (25)	.02[b]
Mean admission platelet count (SD)	235.4 (85.5)	246.2 (68.2)	.47[a]
Mean admission INR (SD)	1.3 (0.8)	1.2 (0.5)	.27[a]
Mean admission aPTT (SD)	27.4 (6.3)	25.4 (5.1)	.08[a]
Altered coagulation (%)	2 (7)	7 (5)	.48[b]
Antiplatelet therapy (%)	6 (22)	18 (14)	.38[b]
Mean initial maximum aSDH width, mm (SD)	6.9 (3.6)	5.8 (3.5)	.12[a]
Mean initial maximum midline shift, mm (SD)	0.40 (0.4)	0.18 (0.3)	.0004[a]
Mean time to follow-up NCCT, hours (SD)	9.58 (7)	11.28 (7.3)	.29[a]

[a] Student *t* test.

[b] Fisher exact test.

[c] Mann-Whitney test.

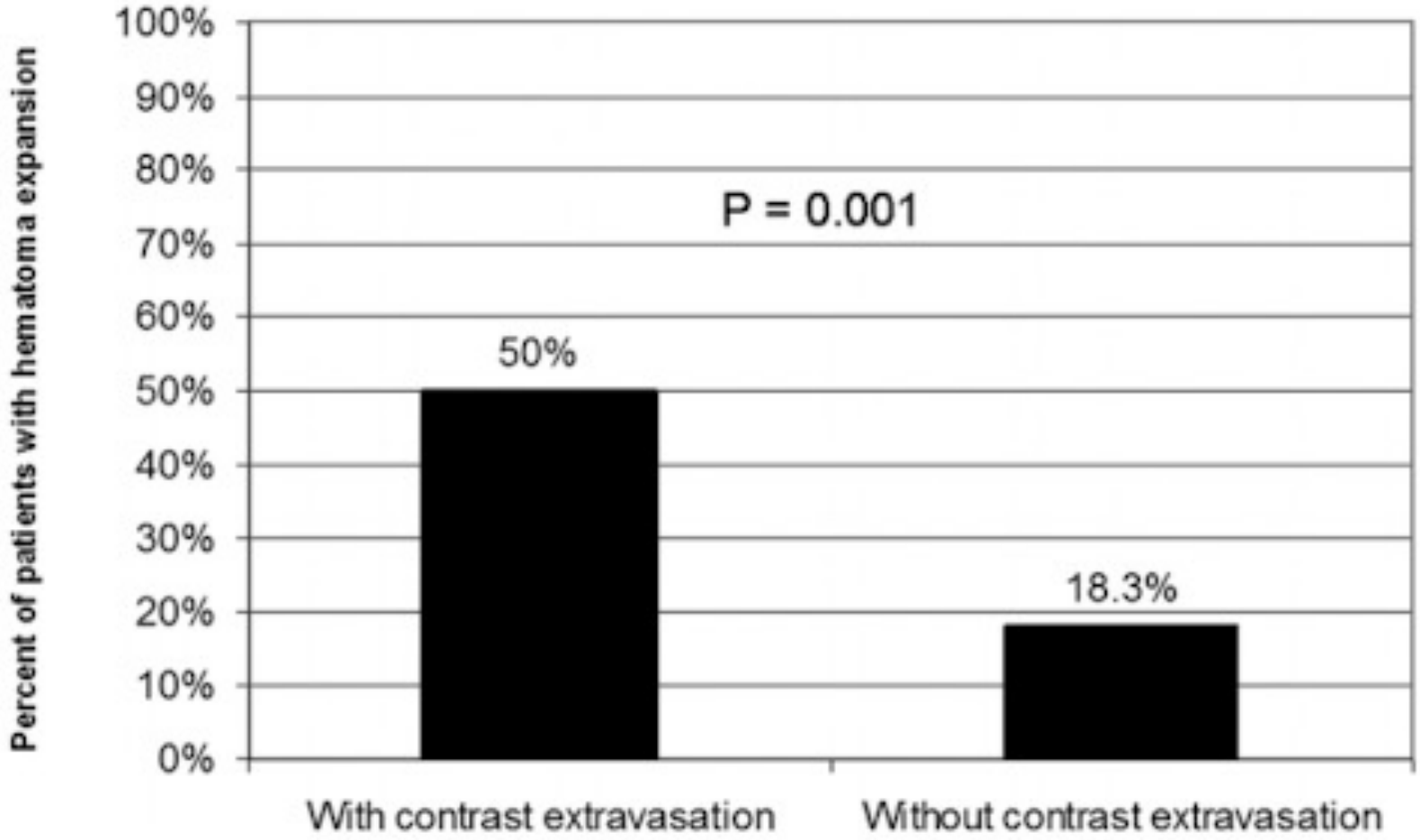

Percent of patients with hematoma expansion
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
P = 0.001
50%
18.3%
With contrast extravasation
Without contrast extravasation

Table 4: Comparison of clinical and radiologic characteristics between surviving and nonsurviving patients with aSDH

Characteristic	Survived (*n* = 140)	Died (*n* = 17)	*P* Value
Mean age, years (SD)	51 (22.4)	59 (23.2)	.16[a]
Sex (%)			.56[b]
Male	103 (74)	14 (82)	
Female	37 (26)	3 (18)	
Mean admission blood pressure, mm Hg			
Systolic (SD)	139.9 (26.5)	147 (29.5)	.37[a]
Diastolic (SD)	76.3 (14.9)	78.2 (14.7)	.66[a]
Mean admission GCS (SD)	12 (3.9)	8 (4.8)	.0003[c]
History of hypertension (%)	38 (27)	8 (47)	.10[b]
Mean admission platelet count (SD)	247.4 (70.4)	219.7 (76.2)	.13[a]
Mean admission INR (SD)	1.2 (0.45)	1.6 (1.0)	.015[a]
Mean admission aPTT (SD)	25.4 (5.1)	28.5 (6.7)	.022[a]
Altered coagulation (%)	7 (5)	2 (12)	.25[b]
Antiplatelet therapy (%)	19 (14)	5 (30)	.14[b]
Mean initial maximum aSDH width, mm (SD)	6 (3.6)	6 (3)	.99[a]
Mean initial maximum midline shift, mm (SD)	2 (2.6)	3.9 (4.2)	.011[a]
Patients with contrast extravasation (%)	18 (13)	9 (53)	.0004[b]
Patients without contrast extravasation (%)	122 (87)	8 (47)	.0004[b]
Mean time to follow-up NCCT, hours (SD)	12 (8.2)	9.7 (5.5)	.27[a]

Result

- extravasationは血腫増大と院内死亡率の上昇の予測因子となり得る

- その他の院内死亡の予測因子は来院時の

①GCS　②APTT　③INR　④midline shift

今日の構成

①現在のASDHの手術のindication

②血腫増大の予測因子

③indicationの再検討

SURGICAL MANAGEMENT OF ACUTE SUBDURAL HEMATOMAS

RECOMMENDATIONS

(see *Methodology*)

Indications for Surgery

- An acute subdural hematoma (SDH) with a thickness greater than 10 mm *or* a midline shift greater than 5 mm on computed tomographic (CT) scan should be surgically evacuated, regardless of the patient's Glasgow Coma Scale (GCS) score.
- All patients with acute SDH in coma (GCS score less than 9) should undergo intracranial pressure (ICP) monitoring.
- A comatose patient (GCS score less than 9) with an SDH less than 10-mm thick and a midline shift less than 5 mm should undergo surgical evacuation of the lesion if the GCS score decreased between the time of injury and hospital admission by 2 or more points on the GCS and/or the patient presents with asymmetric or fixed and dilated pupils and/or the ICP exceeds 20 mm Hg.

Timing

- In patients with acute SDH and indications for surgery, surgical evacuation should be performed as soon as possible.

Methods

- If surgical evacuation of an acute SDH in a comatose patient (GCS < 9) is indicated, it should be performed using a craniotomy with or without bone flap removal and duraplasty.

KEY WORDS: Coma, Computed tomographic parameters, Craniotomy, Decompressive craniectomy, Head injury, Hematoma, Intracranial pressure monitoring, Salvageability, Subdural, Surgical technique, Timing of surgery, Traumatic brain injury

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①血腫＞10mm or ②midline shift＞5mm

上記を全て満たす症例においては
意識レベルに関わらず手術が必要とされている

Neurosurgery. 2006 Mar;58(3 Suppl):S16-24

Acute Subdural Haematoma in the Conscious Patient: Outcome with Initial Non-Operative Management

Acta Neurochir (Wien). 1993;121(3-4):100-8.

	n	Midline shift medial (range) (mm)	Effacement of ipsilateral ventricle	Maximum thickness of haematoma* median (range) (mm)	No. of CT cuts with haematoma* median (range)	Volume of haematoma* (ml)	Ipsilateral low density	Contralat-eral atrophy
Minimal haematoma	8	0 (0–3)	2	5 (3–10)	5.5 (2–6)	< 17	0	4
Significant haematoma								
resolved	9	2.0 (0–10)	4	5 (3–15)	6.0 (4–9)	32 ± 2	3	5
enlarge and required surgery	6	3.0 (1–10)	6	13.5 (8–16)	9.0 (6–11)	53 ± 6**	1	2
Total	23	2.0 (0–10)	12	8 (3–16)	6.0 (2–11)	36 ± 15	4	11

- 保存的加療を行なわれた13≦GCS≦15のASDH(n=23)が対象
- 6人が穿頭ドレナージを要した
- 来院時の血腫径＞10mmが有意に多かった

Limitation

- sampleが少ない
- ASDH以外の病変があれば除外される
- 緊急の開頭血腫除去ではない（手術までの平均時間は15日）
- 意識レベルの増悪も0-2点（最低：12）
- 手術を行う明確な基準がない

Criteria for Conservative Treatment of Supratentorial Acute Subdural Haematomas

Summary

Without mortality, 31 patients underwent conservative treatment for traumatic supratentorial acute subdural haematoma (SDH). Later on six of them had the haematoma surgically evacuated mainly because of a deterioration of the Glasgow Coma Scale (GCS) scores.

It was found that patients with a midline shift of less than 10 mm on the computed tomography (CT) scans and with a GCS score of 15 initially might be treated conservatively under close observation, reserving urgent craniotomy and evacuation of the SDH for those with deteriorating neurological conditions. A smaller degree of midline shift was tolerated by patients with an GCS score of less than 15: a shift of more than 5 mm on the initial CT scans predicted an exhaustion of the cerebral compensatory mechanism within 3 days of injury. In such cases the GCS score worsened, and surgical evacuation of the SDH became necessary.

A total hospital stay of 6 to 7 days may suffice for those who have become fully conscious. Repeat CT studies before discharge should be done and a close follow-up during the first 3 to 4 weeks is advisable.

- n=31
- OP: 6/6、conservative: 2/25でMLS>5mm(P<0.05)

Limitation

- sampleが少ない
- 意識レベルの増悪の程度の記載がない
- 手術を行う明確な基準がない

ActaNeurochir(Wien). 1995;135(1-2):38-43.

Clinical Outcomes After Nonoperative Management of Large Acute Traumatic Subdural Hematomas in Older Patients: A Propensity-Scored Retrospective Analysis

Neurosurgery. 2023 Feb;92(2):293-299

BACKGROUND: Large (≥1 cm) acute traumatic subdural hematomas (aSDHs) are neurosurgical emergencies. Elderly patients with asymptomatic large aSDHs may benefit from conservative management.

OBJECTIVE: To investigate inpatient mortality after conservative management of large aSDHs.

METHODS: Single-center retrospective review of adult patients with traumatic brain injury from 2018 to 2021 revealed 45 large aSDHs that met inclusion criteria. Inpatient outcomes included mortality, length of stay, and discharge disposition. Follow-up data included rate of surgery for chronic SDH progression. Patients with large aSDHs were 2:1 propensity score–matched to patients with small (<1 cm) aSDHs based on age, Injury Severity Scale, Glasgow Coma Scale, and Rotterdam computed tomography scale.

RESULTS: Median age (78 years), sex (male 52%), and race (Caucasian 91%) were similar between both groups. Inpatient outcomes including length of stay ($P = .32$), mortality ($P = .37$), and discharge home ($P = .28$) were similar between those with small and large aSDHs. On multivariate logistic regression (odds ratio [95% CI]), increased in-hospital mortality was predicted by Injury Severity Scale (1.3 [1.0-1.6]), Rotterdam computed tomography scale 3 to 4 (99.5 [2.1-4754.0), parafalcine (28.3 [1.7-461.7]), tentorial location (196.7 [2.9-13 325.6]), or presence of an intracranial contusion (52.8 [4.0-690.1]). Patients with large aSDHs trended toward higher progression on follow-up computed tomography of the head (36% vs 16%; $P = .225$) and higher rates of chronic SDH surgery (25% vs 7%; $P = .110$).

CONCLUSION: In conservatively managed patients with minimal symptoms and mass effect on computed tomography of the head, increasing SDH size did not contribute to worsened in-hospital mortality or length of stay. Patients with large aSDHs may undergo an initial course of nonoperative management if symptoms and the degree of mass effect are mild.

Patients

inclusion
- 2018-2021、後方視的
- 単施設研究、level 1 trauma centerに搬送された症例
- nonoperative management症例
- SDH≧10mm、SDH＜10mm

exclusion
- 0-18歳
- CSDH or subacute SDH
- 入院中に外減圧術を受けた症例
- 鋭的頭部外傷症例
- 救命不可能と判断された症例

Outcome
①死亡率
②入院期間
③転院 or 退院先
④気管切開の有無
⑤PEG作成の有無

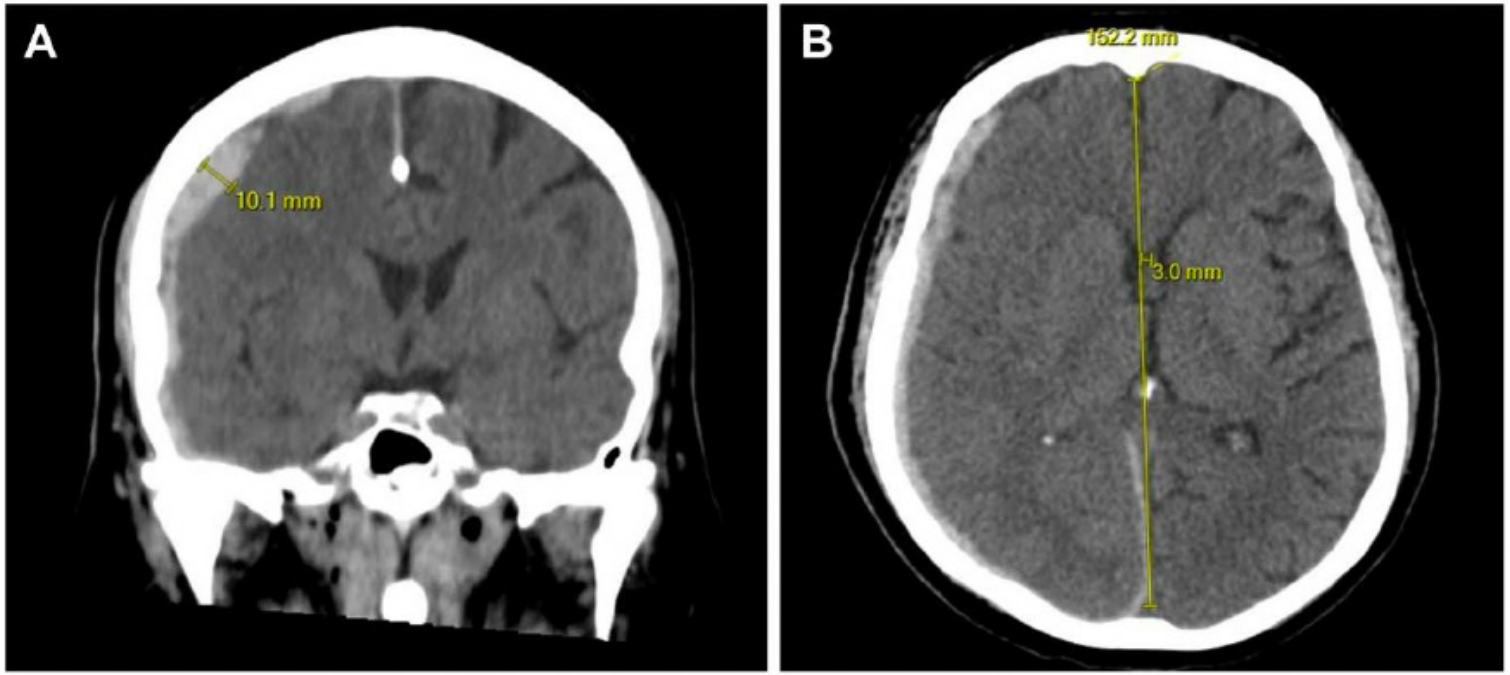

TABLE 1. Rotterdam Computed Tomography Classification[a]

Predictor	Score
Basal cisterns	
Normal	0
Compressed	1
Absent	2
Midline shift	
No shift or shift ≤5 mm	0
Shift >5 mm	1
Epidural mass lesion	
Present	0
Absent	1
Intraventricular blood or subarachnoid hemorrhage	
Absent	0
Present	1
Sum score	+1

TABLE 1. Baseline Patient Characteristics for Nonoperatively Managed SDHs

Variable[a]	SDH < 1 cm (n = 90)	SDH ≥1 cm (n = 45)	*P* value
Age, y	79 (70-86)	80 (71-87)	.606
Male	42 (47%)	28 (62%)	.088
Race			.538
Caucasian	80 (89%)	43 (96%)	
African American	7 (8%)	1 (2%)	
Asian/other	3 (3%)	1 (2%)	
ISS	24 (17-29)	26 (25-27)	.059
GCS			.929
3-8	8 (9%)	3 (7%)	
9-12	6 (7%)	3 (7%)	
13-15	76 (84%)	39 (87%)	
RCS			.654
1-2	84 (93%)	42 (93%)	
3-4	6 (7%)	3 (7%)	
RCS—SAH or IVH	36 (40%)	12 (27%)	.180
RCS—epidural compression	4 (4%)	1 (2%)	.458
RCS—MLS >5 mm	0 (0%)	1 (2%)	.333
RCS—cisterns			.160
Compressed	4 (4%)	5 (11%)	
Absent	0 (0%)	0 (0%)	
Contusion	19 (21%)	6 (13%)	.196
Location			.864
Convexity	61 (68%)	30 (67%)	
Parafalcine	23 (26%)	13 (29%)	
Tentorial	6 (7%)	2 (4%)	

TABLE 2. Inpatient Outcomes After Conservative Management of SDH

Variable[a]	SDH < 1 cm (n = 90)	SDH ≥ 1 cm (n = 45)	*P* value
Mortality	7 (8%)	5 (11%)	.365
Length of stay (d)	5 (3-8)	5 (3-7)	.312
Discharge disposition			.276
Home w/wo services	37 (41%)	22 (49%)	
Acute rehabilitation	14 (16%)	6 (13%)	
SNF/LTACH	32 (36%)	10 (22%)	
Morgue/hospice	7 (8%)	7 (16%)	
Tracheostomy	3 (3%)	0 (0%)	.551
PEG	2 (2%)	0 (0%)	.552

TABLE 4. Univariate Predictors of In-Hospital Mortality

Variable[a]	Alive (n = 123)	Dead (n = 12)	*P* value
Age, y	79 (71-86)	74 (67-86)	.567
ISS	25 (18-26)	32 (26-35)	**<.001**
GCS			**<.001**
3-8	6 (5%)	5 (42%)	
9-12	7 (6%)	2 (17%)	
13-15	110 (89%)	5 (42%)	
RCS			**<.001**
1-2	119 (97%)	7 (58%)	
3-4	4 (3%)	5 (42%)	
RCS—SAH or IVH	40 (33%)	8 (67%)	**.023**
RCS—epidural compression	5 (4%)	0 (0%)	.623
RCS—MLS >5 mm	1 (1%)	0 (0%)	.911
RCS—compressed cisterns	4 (3%)	5 (42%)	**<.001**
Contusion	16 (13%)	9 (75%)	**<.001**
Location			**.015**
Convexity	86 (70%)	5 (42%)	
Parafalcine	32 (26%)	4 (33%)	
Tentorial	5 (4%)	3 (25%)	

TABLE 5. Multivariate Predictors of In-Hospital Mortality

Variable	Odds ratio (95% CI)	*P* value
Age	1.1 (1.0-1.3)	.072
ISS	1.3 (1.0-1.6)	**.029**
GCS (reference: GCS 3-8)		
9-12	4.8 (0.1-246.2)	.433
13-15	3.5 (0.1-111.7)	.486
RCS 3/4	99.5 (2.1-4754.0)	**.020**
Location (reference: convexity)		
Parafalcine	28.3 (1.7-461.7)	**.019**
Tentorial	196.7 (2.9-13 325.6)	**.014**
Contusion	52.8 (4.0-690.1)	**.003**

TABLE 6. Outpatient Follow-Up Data After Conservative Management of SDH

Variable[a]	SDH < 1 cm (n = 90)	SDH ≥ 1 cm (n = 45)	*P* value
Follow-up CTH	49 (54%)	14 (31%)	**.017**
CTH outcome			
Improved	32 (65%)	6 (43%)	.225
Stable	9 (18%)	3 (21%)	
Progressing	8 (16%)	5 (36%)	
Duration follow-up CTH (d)	20 (15-30)	17 (15-20)	.316
Clinical follow-up	42 (47%)	11 (24%)	**.015**
Surgery for chronic SDH	3 (7%)[b]	3 (25%)	.110
Duration to chronic SDH surgery (d)	30 (30-36)	14 (14-15)	.100
Antiplatelet/anticoagulant restarted	8 (19%)	1 (9%)	.665
Steroid started	2 (5%)	0 (0%)	.618

Result

- 血腫径単独では死亡率は変わらない

- その他の外傷（特に頭蓋内病変）、血腫の局在、来院時の意識状態などと総合的に判断が必要

Discussion

- 高齢者が多く、脳萎縮により、血腫拡大の影響を受けにくい
- テント周囲・大脳鎌周囲の血腫による死亡では呼吸不全や、その他の頭蓋内病変による死亡が多い
- 多変量解析においてGCSで有意差が出なかった理由は13≦GCS≦15の症例が大半であったため

Limitation

- conservative management失敗率の記載なし
- 退院後のfollow up期間が短い

Personal view

- ASDHに対して、全例造影CT検査はアリかも
- 血腫径のみでは手術適応は判断できない
- 意識レベル、MLS、その他の頭蓋内病変などがより重要か
- 保存的加療→手術となった症例の退院時mRS、GOSは？
- 将来的に手術が必要と予測される症例に早期手術を行なった場合の予後は？

ちなみに当院では・・・

- 桧山先生が千里に来てから（約5年）

- ASDH症例：293
- 緊急手術症例：55
- 保存的加療：238
- 保存→手術：9（3.8%）