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Zasan's Grading for Unilateral Chronic Subdural Hematomas: Comparison of Clinical Findings on the Background of Radiological Findings

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ABSTRACT

Introduction: A correlation cannot be established between clinical findings and hematoma thickness in chronic subdural hematoma cases. The effects of hematoma on intracranial structures can be evaluated as a grading criterion. This study aims to establish a grading system by establishing a correlation between the compression effects of hematoma and clinical conditions in chronic subdural hematoma cases.
Methods: The radiological and clinical findings of the cases diagnosed with chronic subdural hematoma were recorded. Headache, dizziness, focal neurological deficit, and a reduction in the Glasgow coma scale scores were recorded as clinical criteria. Radiologically, a 4-grade grading system was prepared. Hematoma without compression effect, dural compression and sulcus effacement, parenchymal compression, and a midline shift of more than 5 mm were used in the grading system, respectively. The clinical symptoms and signs within each grade were recorded.
Results: Computed tomography examinations and clinical findings of 414 cases were recorded. As the grade increases, the clinical symptoms and signs increase along with the increase in hematoma thickness. However, an absolute correlation cannot always be established between hematoma thickness and clinical symptoms.
Conclusion: The grading system is instructive in showing the effects of hematoma on intracranial structures rather than hematoma thickness in chronic subdural hematoma cases. Complete drainage of the hematoma is rare in surgically treated cases. Clinical improvement is associated with optimal intracranial dynamics rather than hematoma thickness. The grading system is instructive regarding clinical and radiological follow-up of the cases.

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Introduction

Chronic subdural hematomas (CSDHs) are the most common type of intracranial hemorrhages. They mainly occur based on cerebral atrophy in the advanced age group, and it is known that rupture of the bridging veins plays a role in its etiopathogenesis (1-3). Cerebral atrophy causes a variable degree of subdural space depending on age (4,5). A sudden or progressive increase in intracranial pressure is not expected in patients with atrophic cerebral parenchyma. For this reason, CSDH cases with mild neurologic findings are frequently encountered despite radiologically large hematomas. It is often not possible to establish a correlation between hematoma thickness and neurological findings in CSDH cases.

The effects of hematoma on intracranial

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structures and cerebral parenchyma are the most important criteria associated with neurological status. There are surgical or medical treatment criterias, mainly depending on the radiological criterias for "acute" intracranial hemorrhages (6). On the other hand, adaptation effects for raised intracranial pressure (RICP) occur because bleeding occurs over a long period in "chronic" SDH cases. Therefore, regardless of hematoma width, the radiological findings of the adaptation process should also be considered. For this purpose, regardless of hematoma width, the correlation between clinical findings and grading should be done by evaluating intracranial effects.

Clinical status is related to parenchymal volume rather than hematoma thickness in patients with cerebral atrophy. The compression effect of the hematoma on the atrophic parenchyma tissue is less than that of the normal parenchyma. These effects of hematoma can be understood with the qualitative data to be evaluated radiologically. With these data, clinical-radiological grading can be performed. This grading will help to determine the follow-up and treatment processes and reveal the prognosis quantitatively.

Materials and Method

Cases diagnosed with CSDH between 2013-2021 were identified by scanning hospital service and polyclinic records. Cranial computed tomography (CT) images were obtained from the radiology database. Clinical symptoms and simultaneous cranial CT findings were compared by evaluating the cases' service and outpatient clinic records.

The demographic data of the cases were recorded using Excel software. Symptoms and neurological status were recorded before the radiological examination. As clinical symptoms and signs, dizziness, headache, focal neurological deficit, and Glasgow Coma Scale (GCS) scores were recorded. By examining the cranial CT examinations of the cases, radiological findings were recorded. The hematoma side and thickness were entered into the database.

Radiological examinations were evaluated under four main headings. Only the presence of hematoma, effacement of sulci adjacent to the hematoma, parenchymal compression, and midline shift were recorded as grading criteria, respectively (Table 1). Hematoma thicknesses and grades were compared, and hematoma thickness averages for each grade were calculated. As clinical symptoms; being asymptomatic, headache, dizziness, focal neurologic deficit, and a decrease in GCS (GCS: <15) were recorded, and the incidence of symptoms and signs according to each radiological grading were compared.

Table 1: Radiological grading criteria in unilateral chronic subdural cases

Grade 1	**Presence of hematoma**	
Grade 2	Dural compression and/or sulcus effacement	(+Grade 1 findings)
Grade 3	Parenchymal compression	(+Grade 2 findings)
Grade 4	Midline shift (>5mm)	(+Grade 3 findings)

Cranial CT examinations and clinical findings at the earliest three weeks after surgical intervention were included in the study. The study did not evaluate the data of the cases in which sufficient clinical data could not be obtained simultaneously with the CT examination. The surgical prognoses of the operated cases were not evaluated in the study.

Ethics Committee: The Ahi Evran University Clinical Studies Ethics Committee (file no.: 2021-10/109) approved the study.

Due to the study's retrospective nature, informed consent was not obtained from any of the cases.

Results

A total of 414 cases met the study criteria. Amid the initial diagnosis, the mean age of the cases was 66.96±11.46 and 268 (64.73%) cases were male and 146 (35.27) were female. CSDH was detected on the right side in 182 (43.96%) cases and on the left in 232 (56.04) cases. The mean hematoma thickness detected during diagnosis in all cases was calculated as 11.54±5.75 mm. Furthermore, 377 cases were operated on.

The most common clinical symptom in all cases and grades was dizziness (69.46%) and it was observed that the headache symptom started to increase significantly from grade 2 onwards. The incidence of focal deficit increased was also reported as the grade increased. It was determined that the focal deficit rate was higher in cases with CSDH on the left side. A decrease in GCS was detected in grade 3 and grade 4 cases.

The distribution of cases according to

Table 2: Distribution of cases according to radiological grading (CSDH: chronic subdural hematoma, CT: computed tomography

	CSDH on Right Side		CSDH on Left Side	
	No (CT)	**Mean Thickness (mm)**	**No (CT)**	**Mean Thickness (mm)**
Grade 1	309	7,07 ± 1,41	403	7,04 ± 1,38
Grade 2	172	10,39 ± 1,65	293	10,35 ± 1,69
Grade 3	92	14,57 ± 2,80	94	15,05 ± 2,73
Grade 4	135	21,64 ± 2,78	173	21,75 ± 2,81

Table 3: Hematoma thicknesses and distribution of clinical symptoms and signs by grading (GCS: Glasgow Coma Scale)

	Mean Thickness (mm)	Headache	Dizziness	Focal Deficit	GCS<15
Grade 1 (n=712)	7,05 ± 1,39	377 (52,94%)	420 (58,99)	4 (0,6%)	0
Grade 2 (n=465)	10,37 ± 1,67	316 (67,95%)	335 (72,04)	11 (2,37%)	0
Grade 3 (n=186)	14,81 ± 2,77	141 (75,81%)	147 (79,03%)	15 (8,06%)	8 (4,30%)
Grade 4 (n=308)	21,70 ± 2,79	249 (80,84%)	258 (83,77%)	52 (16,89%)	21 (6,82%)

radiological grading is shown in Table 2. Hematoma thicknesses and distribution of clinical symptoms and signs by grading are showen in Table 3.

The distribution of clinical signs and symptoms by grading and hematoma side is shown in Table 4.

Discussion

The general approach in CSDH cases is surgery for large and symptomatic hematomas.(1,7) In "acute" SDH cases, the indication for surgery according to radiological criteria is a 10 mm or 5 mm midline shift. However, the standard quantitative radiological criteria for "chronic" SDHs have not been clearly defined.

CSDHs are mostly diagnosed cases without signs of RICP since they have intracranial hemorrhages developed based on cerebral atrophy at a very high rate.(8,9) In these cases, it is argued that due to the compression effect of the hematoma on the cortical vascular structures in the early period, the vascular flow decreases, and the symptoms begin as dizziness in the early period (8).

Radiological examination of an extra-axial space-occupying and a growing space-occupying lesion is expected to cause dural compression, sulci effacement, parenchymal compression, and midline shift, respectively. According to this order, a late radiological finding almost always includes radiological findings from the previous period (Figure 1 and Figure 2). Clinical findings are expected to change simultaneously with these radiological findings. Focal neurological deficits can be considered an exception since not all elegant areas are symmetrical.

A lesion that has not shown a significant compression effect on intracranial structures is not expected to cause a significant increase in intracranial pressure. Therefore, headache as one of the early symptoms of RICP should not be routinely expected in these cases because headache is usually a multifactorial and nonspecific complaint and it may not always be considered as a specific marker in cases with RICP. On the other hand, long-term dizziness can be considered a more precisely symptom and is the reason for presenting to a healthcare institution. In the study, it was understood that the headache in the cases detected as grade 1 was not the typical RICP-related headache and that other findings related to RICP were not accompanied at the same rate.

When an intradural extra-axial space-occupying lesion has a pressure effect greater than parenchymal resistance, it is expected to begin to exert its parenchymal compression effect. One of the most prominent early signs of this is the loss of prominence of the sulci on the cortical surface. Along with this criterion, which is considered one of the early signs of RICP due to the extra-axial space-occupying lesion, it has been observed that the incidence of headache has increased in the

Table 4: Distribution of clinical signs and symptoms by grading and hematoma side (CSDH: chronic subdural hematoma, GCS: Glasgow Coma Scale

	Left Side CSDH				Right Side CSDH			
	Headache	**Dizziness**	**Focal Deficit**	**GCS<15**	**Headache**	**Dizziness**	**Focal Deficit**	**GCS<15**
Grade 1 (n=712)	173 (24,30%)	225 (31,60%)	3 (0,4%)	0 (0,0%)	204 (28,65%)	195 (27,39%)	1 (0,14%)	0 (0,0%)
Grade 2 (n=465)	160 (34,41%)	177 (38,06%)	8 (1,72%)	0 (0,0%)	126 (27,10%)	148 (31,83%)	3 (0,65%)	0 (0,0%)
Grade 3 (n=186)	70 (37,63%)	87 (46,78%)	11 (5,91%)	5 (2,69%)	71 (38,17%)	60 (32,26%)	4 (2,15%)	3 (1,61%)
Grade 4 (n=308)	138 (44,81%)	145 (47,08%)	37 (12,01%)	13 (4,22%)	111 (36,04%)	113 (36,69%)	15 (4,87%)	8 (2,60%)

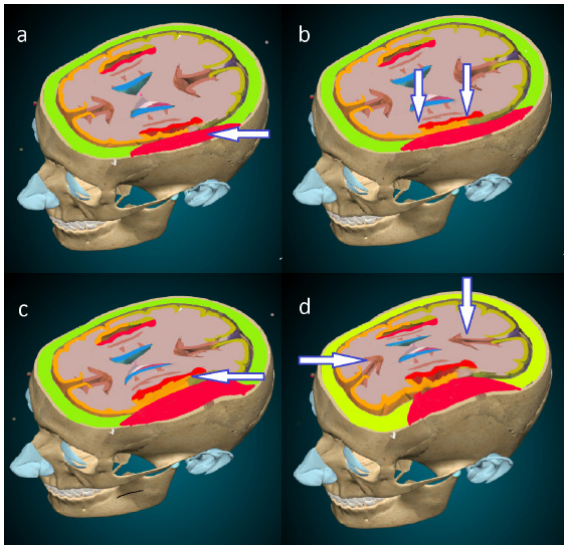

Figure 1: Grading of subdural hematoma according to its intracranial effects is illustrated. Grade 1: Subdural hematoma without compression effect (a). Grade 2: CSDH causes sulci effacement (b). Grade 3: CSDH with sulci effacement and parenchymal compression (c). Grade 4: CSDH with sulci effacement, parenchymal compression, and midline shift (d)

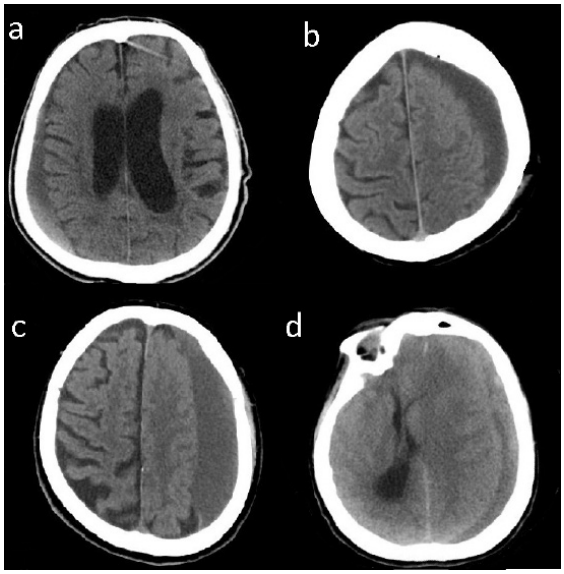

Figure 2: There is no correlation between hematoma thickness and parenchymal compression. Grade 1(a), Grade 2(b), Grade 3(c), and Grade 4(d) hematomas. Grade 4 CSDH, which has the least hematoma width, but causes midline shift (d)

cases. In the following process, the parenchyma is expected to remain under compression. The following process is the formation of a midline shift in the parenchyma.

In high-grade cases, focal neurological deficits due to elegant area involvement should be expected.(1,2) Neurological deficits are often due to cortical involvement and cortical compression is described in at least grade 3 cases. If midline shift has also occurred, coma findings may also occur in cases, and it may not be possible to evaluate isolated eloquent area injuries other than hemiparesis and hemiplegia. Coma findings occur immediately, especially in cases with midline shift due to acute hemorrhages. In CSDH cases, comatose findings may not have occurred even if a midline shift has occurred. A greater tolerance to RICP is expected due to the atrophic cerebral parenchyma.

It is known that according to the Monroe-Kelly doctrine, in cases with RICP, the pressure increase first shows a linear course and then enters the logarithmic increase process. Midline shift in unilateral space-occupying lesions is considered the most prominent radiological finding of the logarithmic process. Due to the high tolerance to increased intracranial pressure in CSDH cases, the radiological grading of the cases is expected to be high at the initial diagnosis. For this reason, these cases in which tolerance decreases after the adaptation process are considered emergencies. In CSDH cases, the latest radiological finding is the midline shift, and it may not be predicted how long the tolerance process will take after this stage. These cases are considered to have entered the logarithmic increase process for RICP.

In CSDH cases, it is not rational to decide on the treatment method based on radiological or clinical findings alone. The vast majority of cases are elderly and have “variable degrees” of cerebral atrophy, resulting in different adaptation mechanisms and tolerance limits. For these reasons, it is impossible to establish a quantitative correlation between neurological status and radiological findings. It is possible to encounter very high residual CSDH due to cerebral atrophy in the early and late postoperative radiological examinations of operated CSDH cases. For this reason, surgical intervention aims not to drain the hematoma completely.

In CSDH cases, grading provides a semi-quantitative evaluation in terms of the prognosis of the cases. In these cases, the correlation of hematoma with changes in intracranial structures and clinical findings is important in predicting prognosis. The grading system will guide the evaluation of the follow-up and treatment results of CSDH cases.

Conclusion

CSDH grading allows for semi-quantitative assessment of the prognosis of the cases. The grading system can be a guide in predicting postoperative outcomes in surgically–treated cases.

Conflict of interest

The author declares that there is no conflict of

interest regarding the publication of this article.

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