CASE REPORT

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Predictor scale of delayed cerebral ischemic in aneurysmal subarachnoid hemorrhage case series: what a radiologist should know

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ABSTRACT

Introduction: Delayed cerebral ischemic (DCI) was one of the most difficult and occurs in about 30% of patients with aneurysmal subarachnoid hemorrhage (aSAH) that could be predicted from computed tomography (CT) scans findings with the Fisher scale, modified Fisher scale, Claassen scale, and scale Hijdra score.

Case description: We reported 5 cases of aSAH at different locations with different DCI prediction scales. 4 of our 5 cases were treated for clipping aneurysm, but in the end, all of our cases developed DCI in the period of 10 to 14 days after aSAH from the mild form of hemiparesis to death.

Discussion: CT scan could predict DCI by some predictor scale. The first predictor scale was the Fisher scale, divided into four classes by assessing the amount of blood. Besides, the modified Fisher scale separated classes for patients with thick blood in the cisterna and IVH. The other scale was the Claassen Scale, which detailed the site of intraventricular blood-filled. Hijdra score is a broader alternative scale but requires more time, which assessed each cisterna amount of blood separately. The outcome was clinical DCI, defined by at least the occurrence of new focal neurological signs or a decrease in consciousness, with or without angiographic vasospasm or new infarct.

Conclusion: The high incidence of DCI leading to death in aSAH indicates the importance of accurate early diagnosis. Therefore, it is necessary to have an in-depth understanding of the essential imaging findings that include the Fisher scale, modified Fisher scale, Claassen scale, and Hijdra score to quickly and accurately guide patient management.

Keywords: Delayed Cerebral Ischemia, Aneurysmal Subarachnoid Hemorrhage, Fisher scale

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INTRODUCTION

Delayed Cerebral Ischemia (DCI) is defined as the appearance of new focal neurological signs or decreased consciousness level, lasting for more than 1 hour or new infarction on CT or MRI.[1,2] This definition is more meaningful than symptomatic vasospasm (new neurological deficits or decreased level of consciousness due to vasospasm), especially in patients with severe aneurysmal subarachnoid hemorrhage (aSAH) whose neurological damage may not be apparent.[3] Narrowing of the arteries can be seen on angiography in 50-70% of patients and causes DCI in 19-46% after SAH. The appearance of DCI starts on third day after SAH, maximum on days 5-14.[1,3]

The incidence of aSAH is around 6-11 per 100,000 people per year.[1,2] Because the affected population's age is relatively young, the high level of disability is a burden on productive societies.[3] Over the past two decades, advances in understanding SAH pathophysiology and scale have led to a reduction in mortality.[4] Despite this progress, about 30% of patients after aSAH experience disability, while 69% report a decrease in quality of life.[6] DCI is recognized as one of the leading causes of decreased quality of life after aSAH.[8] The extent of subarachnoid hemorrhage on computed tomography (CT) scanning is one of the strongest predictors of DCI[3-5] with the Fisher scale, modified Fisher scale, or Hijdra score. We aim to carry out a thorough analysis to assess the relationship of the Fisher scale, the modified Fisher scale, and the clinical Hijdra score with DCI from some of our cases.

CASE 1

Male patient, 34 years old, came to Sanglah Hospital with complaints of decreased consciousness for about 5 hours before entering the hospital. Initially, the patient had complained of severe headaches. Physical examination obtained E2V5M3 GCS with NIHSS 5 and Hunt & Hess scale 3. The patient then underwent CT scan of the head angiography and found aneurysm anterior communicating artery with ruptured signs (Intra Cerebral Hemorrhage in the right frontal lobe accompanied by pericallosal

hematoma), Intraventricular Hemorrhage in left and right lateral ventricles, III, and IV, thick Sub Arachnoid Hemorrhage (SAH) that fills the frontal interhemispheric fissure, Sylvii fissure on the left and right sides, left and right basal sylvian fissures, suprasellar cisterna right, and quadrigeminal cisterna and lateral sylvian fissures moderate on the left and right cisterna (Figure 1). From the results of this CT scan, analyzed using the DCI prediction scale; namely, FISHER 4, modified FISHER 4, Claassen 4, and Hidjra score 36. The patient then performed aneurysm clipping one day later, and after 10 days, the patient experienced a decrease in consciousness that is still in care.

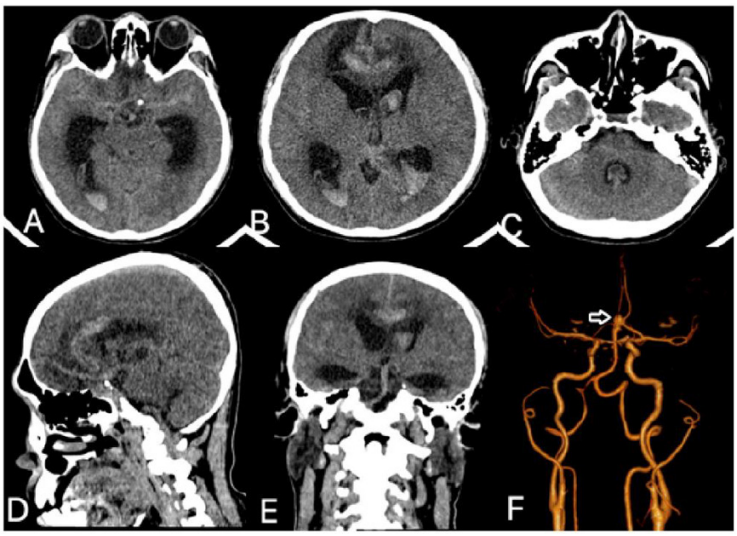

Figure 1. Results of CT scan angiography of the head of the first case. A. Sub Arachnoid Hemorrhage (SAH) thick that fills the basal cisterna. B, C, D, E. ICH in the right frontal lobe accompanied by pericallosal hematoma, IVH in the left right lateral ventricle, III, and IV. F. Aneurysm anterior communicating artery (arrow).

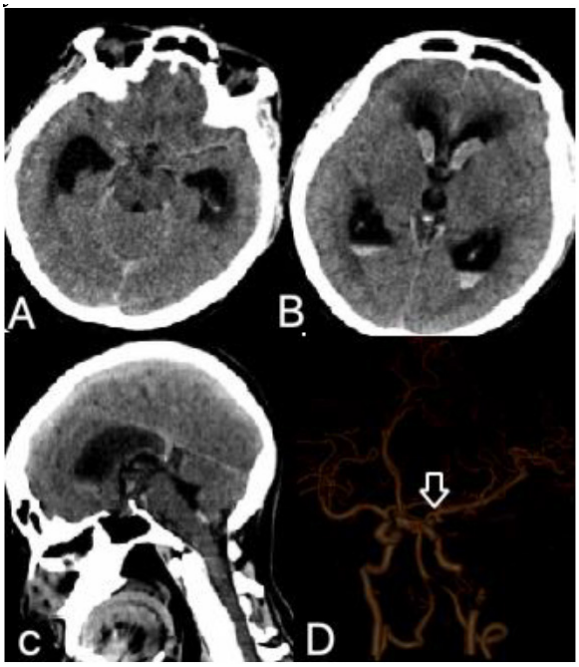

Figure 2. Results of CT scan for head angiography of second case. A. Minimal SAH in the frontal interhemispheric fissure, while in the sylvian fissure, the right and left basal cisterna, the left and right ambient cisterna, and the left and right suprasellar cisterna. B, C. Left and right lateral ventricular IVH and III. D. Saccular aneurysm in the internal carotid artery of the supraclinoid sinistra.

CASE 2

Female patient, 47 years old, came to Sanglah Hospital with complaints of decreased consciousness for about 8 hours before entering the hospital. Initially, the patient had complained of severe headaches. Physical examination showed GCS E3V5M2 with NIHSS 5 and Hunt & Hess 3 scale. The patient then underwent CT scan of the head angiography and found saccular aneurysm with neck (+), a diameter of about 0.2 cm in the internal carotid artery supraclinoid, lateral ventricular IVH left and right III, minimal SAH in the frontal interhemispheric fissure, while in the sylvian fissure, the left and right basal region, left and right ambient cisterna and thick in the left and right suprasellar cisterna and cerebral edema (Figure 2). From the results of this CT scan, analyzed using the DCI prediction scale; namely, FISHER 4, modified FISHER 4, Claassen 4, and Hidjra score 21. The patient then received medical therapy (Citicoline and other symptomatic therapies) for 4 days until complaints improved, and the patient was discharged. Then after 10 days the first complaint arises, the patient experiences a weak right half body.

CASE 3

Female patient, 69 years old, came to Sanglah Hospital with complaints of decreased consciousness since about 8 hours before entering the hospital. Initially, the patient had complained of severe headaches. Physical examination revealed that GCS E2V3M2 with NIHSS scale 18 and Hunt & Hess 2. The patient then underwent CT scan of the head angiography and found aneurysm rupture of the left side anterior communicating cerebral artery, with SAH frontal interhemisphere fissure, lateral sylvian fissure, and right basal rupture left, right and right suprasellar cisterna, left and right ambient cisterna, quadrigeminal cisterna, and IVH on the right and left lateral ventricles and partial stenosis on the right ICA as high as pars petrosa (Figure 3). From the results of this CT scan, analyzed using a DCI prediction scale; namely, FISHER 4, modified FISHER 4, Claassen 4, and Hidjra score 34. The patient was performed aneurysm clipping 1

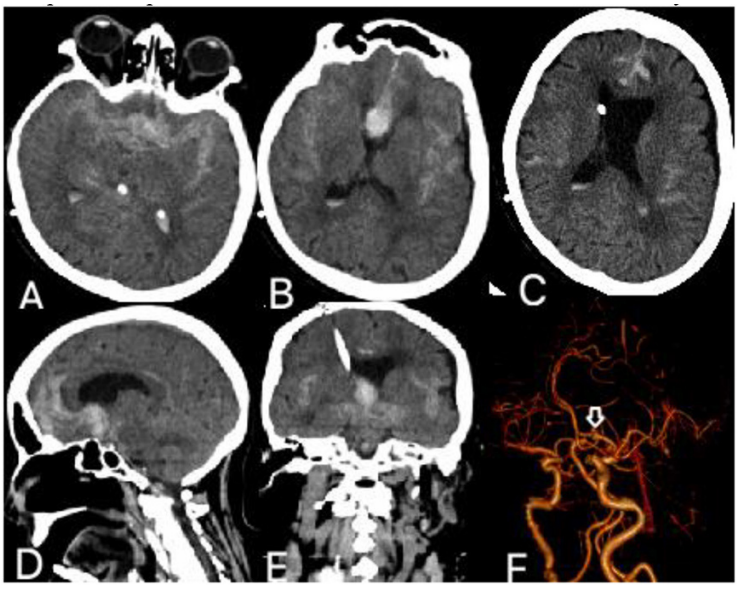

Figure 3. The results of the CT scan of the head of the third case show aneurysm rupture of the left-sided anterior cerebral arteries, with left-sided interhemispheric fissures, lateral and basal sylvian fissures, left and right basal cisterna, right suprasellar cisterna, quadrigeminal cisterna, and IVH in the left-right lateral ventricle, and IVH in the left-right posterior cornuate lateral ventricle and partial stenosis in the right ICA as high as pars petrosa.

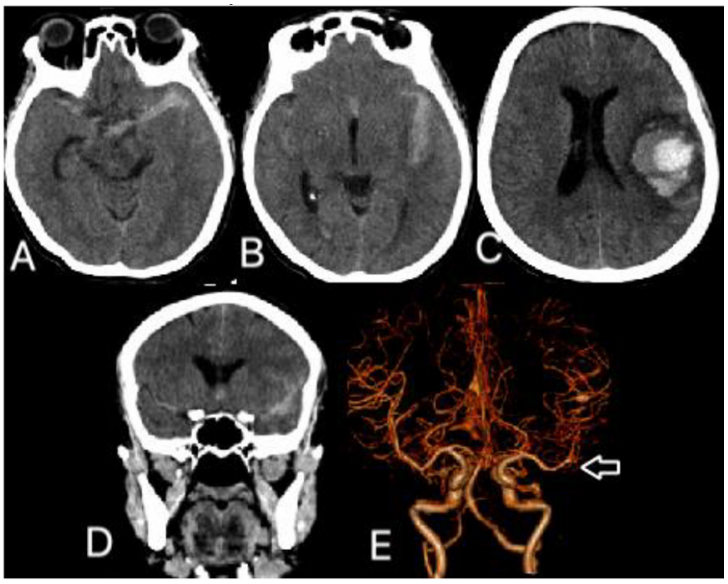

Figure 4. The results of the CT scan of the head of the sixth case show ICH in the cortical to subcortical lobes of the right temporo-parietal lobe, right midline shift, insistence and mild narrowing of the left lateral ventricle, SAH being the frontal interhemispheric fissure, sylvian fissure of the basal and right lateral , left ambient cisterna, thick in left basal and lateral sylvian fissures, left right suprasellar cisterna, right ambient cisterna, due to sessile aneurysm rupture in the left M3 MCA segment.

day later, and after 14 days, the patient experienced a decrease in consciousness until he finally died.

CASE 4

Female patient, 54 years old, came to Sanglah Hospital with complaints of decreased consciousness for about 6 hours before entering the hospital. Initially, the patient had complained of severe headaches and weak right half of the body since 1 day before entering the hospital. Physical examination revealed GCS E2V4M2 with NIHSS 13 scale and Hunt & Hess 2. The patient then underwent a CT scan of the head angiography and found ICH in cortical to subcortical left temporoparietal lobe with a volume of approximately 26 cc, accompanied by peripheral edema around, midline shift to the right as far as 0.3 cm, insistence, and mild narrowing of the left lateral ventricle, SAH being the frontal interhemisphere fissure, cisterna fissure of the basal and lateral right, cisterna of the left ambient cisterna, thick on the sylvian fissure of the left basal and lateral, cisterna suprasellar left, cisterna right ambient, due to ruptured sessile aneurysm in the left M3 MCA segment with a diameter of approximately 0.6 cm (Figure 4). From the results of this CT scan, analyzed using the DCI prediction scale; namely, FISHER 3, modified FISHER 3, Claassen 3, and Hidjra score 23. The patient was performed aneurysm clipping 1 day later, and after 12 days, the patient experienced a decrease in consciousness until he finally died.

CASE 5

Male patient, 57 years old, came to Sanglah Hospital with complaints of decreased consciousness for about 6 hours before entering the hospital. Initially, the patient had complained of severe headaches. Physical examination showed E2V4M2 GCS with NIHSS 19 scale, and SICH score 4. The patient then underwent a CT scan of the angiography of the head and found ICH genu corpus callosum, the possibility of saccular aneurysm on the anterior communicating artery, partial stenosis of the right vertebral artery, thinner SAH of the region of corpus callosum, the possibility of saccular aneurysm on anterior communicating artery, partial stenosis of right vertebral artery left and right parietal and frontal interhemispheric fissures, communicating hydrocephalus with bilateral lateral ventricular IVH, III and IV (Figure 5). From the results of this CT scan, analyzed using a DCI prediction scale; namely, FISHER 4, modified FISHER 2, Claassen 2, and Hidjra score 11. The patient was performed aneurysm clipping 2 days later, and after 13 days, the patient experienced a decrease in consciousness until he finally died.

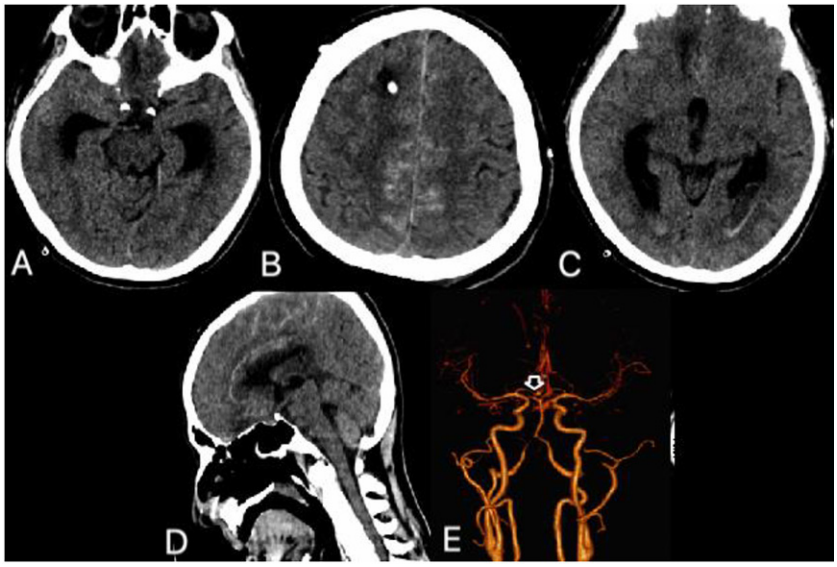

Figure 5. The results of the CT scan of the head of the seventh case show the presence of ICH genu corpus callosum due to rupture of the saccular aneurysm in the anterior communicating artery, partial stenosis of the right vertebral artery, thin SAH of the left-right parietal region, and interhemispheric frontal fissure, communicant artery with hydrocephalus Bilateral lateral ventricular IVH, III and IV.

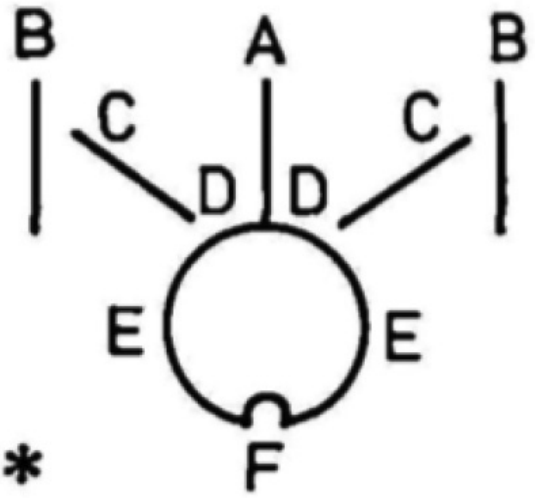

Figure 6. Diagram 10 basal cisterna and fissure: A, frontal interhemisphere fissure; B, sylviic fissure, lateral section; C, sylviic fissure, basal part; D, suprasellar cisterna; E, ambient cisterna; F, quadrigeminal cisterna.

Table 1. Summary of DCI prediction scales based on CT head scan findings

SCORE	FISHER	MODIFIED FISHER	CLAASSEN
0		No SAH/ IVH	No SAH/ IVH
1	No blood detected	Focal or diffuse, thin SAH, no IVH	Thin SAH, no IVH in both lateral ventricles
2	Diffuse deposition of a thin layer with all vertical layers of blood (interhemispheric fissure, insular cistern, ambient cistern) < 1mm thick	Focal or diffuse, thin SAH, with IVH	Thin SAH, with IVH in both lateral ventricles
3	Vertical layers of blood ≥ 1 mm thick or localized clots (clots defined as > 3x5 mm)	Focal or diffuse, thick SAH, no IVH	Thick SAH, no IVH in both lateral ventricles
4	Diffuse or no subarachnoid blood, but with intracerebral or intraventricular clots	Focal or diffuse, thick SAH, with IVH	Thick SAH, with IVH in both lateral ventricles

DISCUSSION

There are several DCI predictor scales based on CT head scans' findings without contrast, including the Fisher scale, modified Fisher, Claassen and Hidjra scores. The first predictor scale was introduced by Fisher et al. in 1980 divided into four classes by assessing the amount of blood into no bleeding (grade 1), thin diffuse expansion (<1 mm) (grade 2), thick (> 1 mm) (grade 3), or amount thin blood in the subarachnoid in the presence of intraventricular hemorrhage (IVH) or intracerebral hemorrhage (ICH) (grade 4).[7] There is an adjusted version of the Fisher scale called the modified Fisher scale.[8,9] This scale introduces separate classifications for patients with thick blood in the cisterna and IVH. Another alternative scale that is broader but takes more time is the Hijdra score, which assesses the amount of blood in each cisterna separately (Figure 6), basal cisterna and fissure values according to the amount of extravasation (no blood 0, minimum 1, medium 2, full / clot 3) and blood count values in the four ventricles (no blood 0, sedimentation in the posterior part = 1, partially filled 2, fully filled = 3).[4] The differences in the rating of the DCI prediction scale in aSAH are summarized in Table 1.

Several studies have assessed the relationship between this radiological assessment scale with DCI occurrence.[4,7-10] When the Fisher scale was introduced, DCI was believed to be caused

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by vasospasm. At present, DCI is considered a multifactorial process, which results in neurological damage.[12] It has been proven in experimental and clinical studies that aneurysm rupture is accompanied by an increase in intracranial pressure caused by extravasation of arterial blood into the subarachnoid space, as well as the vasodilatory cascade causing a decrease in brain perfusion pressure, and finally to the cessation of cerebral blood flow (manifested clinically as syncope or syncope loss of consciousness), and consequently, global ischemia, and then edema. The pathophysiology of DCI is complex and not fully understood. Until now, it was believed that there was a direct relationship between arterial narrowing seen on angiography and clinical symptoms of ischemia (focal neurological signs, such as aphasia or hemiparesis, or decreased consciousness, usually with gradual onset and often fluctuating) mostly between days 4 and 10 to 14 days after aSAH.

CONCLUSION

The high incidence of DCI leading to death in ASS demonstrates the importance of accurate early diagnosis. Therefore, an in-depth understanding of the essential points of imaging findings is needed, including the Fisher scale, modified Fisher scale, Claassen scale, and Hijdra score to guide patient management quickly and accurately.

CONFLICT OF INTEREST

The author declares there is no conflict of interest regarding the publication of the current case report.

ETHICAL CONSIDERATION

The patient or family had received information and signed informed consent regarding data publication before any data collection.

AUTHORS CONTRIBUTION

All authors have contributed equally to all processes in this report, including preparation, data gathering, drafting, and approval for publication of this manuscript.

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