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Intraparenchymal Cerebellar Capillary Hemangioma in a 32-Year-Old Man: a Case Report

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14 **Keywords:** capillary hemangioma, immunohistochemistry, intracranial tumor, neurosurgery,
15 **oncology**

16 **Abstract**

17 The authors present an unusual case of a 32-year-old adult male with a capillary hemangioma,
18 which developed within the left cerebellar parenchyma. The histopathological examination reveals a
19 mass mostly formed by the proliferation of capillaries, lined by a layer of flat-plump endothelial
20 cells, some branching and dilating large capillaries, forming a lobulated structure separated by
21 fibrocollagenous connective tissue. Immunohistochemistry examination with CD31 and S100 was
22 positive on the endothelial and stromal cells, respectively, and negative S100 on the endothelial cells.
23 Although rare, capillary hemangioma should be one of the differential diagnoses for diagnosing intra-
24 axial lesions in the cerebellar region. Confirmation of the histopathological characteristic is necessary
25 to determine the diagnosis of capillary hemangioma and exclude other differential diagnoses.

26 **1 Introduction**

27 Capillary hemangioma is a benign vascular mass or vascular tumor due to abnormal growth of
28 small blood vessels, often found in the skin and connective tissue of neonates or infants and rarely
29 developed in adults. It is reported to have a 1.1 – 2.6% prevalence in neonates, especially in the face,
30 scalp, chest, or back area (1,2). Additionally, intracranial involvement of capillary hemangiomas has
31 been reported rarely, and its exact prevalence is not known. Most of these cases originate from the
32 dura mater and are classified as extra-axial masses. Intra-axial hemangiomas are found less
33 frequently than extra-axial masses (3,4). To the best of the author's knowledge, no capillary
34 hemangioma has been reported intra-axially within the cerebellar parenchyma.

35 We present a case report of an intraparenchymal cerebellar capillary hemangioma developed in
36 a 32-year-old man. We provide a detailed description of the clinical history, examination, operative
37 procedure, histopathological findings, postoperative management, and discussion of this case based
38 on previously reported studies and literature.

39 **2 Case Description**

40 History

41 A 32-year-old man was brought to the emergency room complaining weakness of all 4
42 extremities since 1 day prior. This symptoms accompanied by balance disorders. He felt like swaying
43 and difficulty to get up from the bed. He also complained of chronic headaches since five months
44 prior, especially on the back of the head, with characteristics of being tied to a tightrope, intermittent,
45 and only slightly improved with over-the-counter analgesics. There is no history of sensory
46 abnormalities, seizures, nausea, and vomiting. There was no history of weight loss or similar
47 complaints in this patients. There is no history of heredity in the patient's family who suffers from
48 similar complaints or suffers from central nervous system tumors and tumors in other body locations.

49 The patient underwent a magnetic resonance imaging (MRI) examination at that time. A
50 tumor was found in the left cerebellar area with suspicion of brain tumor with acute hydrocephalus.
51 The patient was advised to undergo a shunt procedure; his symptom improved on the first month
52 after the surgery, there was an improvement in headache and reduced weakness in all four
53 extremities, but a slight balance disturbance was felt.

54 Examination

55 We found a normal vital sign with a visual analog scale of 6 and the Karnofsky Performance
56 Scale of 70. A general physical examination revealed no abnormalities. No tumor or vascular lesions
57 were found on the patient's skin such as spider angiomas or other lesions. On neurological
58 examination, it was found that there was a motor weakness in each of the upper and lower
59 extremities, with each MMT score of 3. The patient's physiological reflexes were normal, without
60 any pathological reflex was noted. From sensory examination, no abnormalities were found. On
61 examination of cerebellum functions such as dysdiadochokinesis, heel-knee tests, and forefinger
62 tests, no significant abnormalities were found on these examinations.

63 MRI examination revealed intra-axial masses on the left cerebellar parenchyma with a well-
64 defined and contrast-enhanced border (Figure. 1A – 1C). On the T2 sequence, we found multiple
65 septae inside the lesion with a hyperintense feature, which has the same intensity as the cerebrospinal
66 fluids. In addition, we also found dilated ventricle with periventricular edema suggested as
67 hydrocephalus. We then performed a shunt procedure followed by tumor removal.

68 Operative Procedure

69 We performed a midline suboccipital craniotomy to expose the tumor. Dura was incised using
70 Y-shaped incision and exposed severely edema of the cerebellum. tumor removal begin from the
71 punctate over the left cerebellar cortex. A reddish wall cystic mass appeared with a highly vascular
72 configuration on the posterior surface of the left cerebellum. A yellowish liquid appears on the inside
73 of the mass and due to high intracranial pressure the cystic contain burst out through the corticotomy
74 side (Figure 2). The mass was found adjacent to the left transverse sinus. Tumor removal was
75 performed in such manner to preserve the transverse sinus. After performing gross total removal of

76 the tumor, adequate hemostasis was achieved using bipolar and hemostatic agent. The dura was then
77 closed using a watertight fashion. The nuchal muscles and ligaments were reconstruct to achieved
78 good craniovertebral muscle stabilization, followed by closing of the skin layer by layer. The mass
79 was sent for further pathological examination.

80 Histopathological Findings

81 On the macroscopic cross-section, the mass was grayish-white mixed with red color, measured
82 around 3×2×0.2 cm in diameter with a wall thickness of 0.1-0.2 cm. On microscopic cross-sections,
83 the mass appears to be well-defined with the surrounding tissue without being covered by a capsule
84 (Figure. 3A). The mass is formed by the proliferation of capillaries, which are lined by a layer of flat-
85 plump endothelial cells with some of the lumen filled with erythrocytes (Figure. 3D). Pericytic cells
86 are seen under the endothelial cells of the blood vessels. These blood vessels form a lobulated
87 structure that varies, where each part is separated by fibro collagenous connective tissue (Figure. 3C).
88 There are some large capillaries, following the description of the parent vessels, where branching and
89 dilatation are visible (Figure. 3B). Some features of mitosis can also be found. Based on the
90 histopathological description, it can be concluded that the mass shows the characteristics of capillary
91 hemangioma. The specimen was examined under a microscope with hematoxylin-eosin (HE) staining
92 and 40x, 100x, and 400x magnification. These findings were supported by immunohistochemistry
93 (IHC) examination for S100 and CD31 of the mass. It reveals positive CD31 on the endothelial cells
94 and S100 on the stromal cells with negative S100 on the endothelial cells (Figure. 4). These results
95 conclude that the mass was truly a blood vessel tumor, consistent with a hemangioma.

96 Postoperative management

97 The patient was hospitalized for seven days, and during postoperative course, the patient felt
98 symptoms improvement especially the increase in muscle power over the all four extremities. The
99 patient could barely walk with assistive devices such as a cane on day fifth day after the surgery. The
100 patient was discharged on day seven without any associated symptoms or new neurological deficits.
101 The patient was only given analgesia as a home remedy, accompanied by routine control two times
102 weekly with routine physiotherapist exercise. One month after surgery he can easily mobilize without
103 any assistive device.

104 3 Discussion

105 Capillary hemangioma is a benign tumor consisting of abnormal growth of capillaries. Usually,
106 they appear in the first six months of life. It grows rapidly until it reaches 12 months of age and
107 usually undergoes complete spontaneous regression by five years (2). Capillary hemangiomas in
108 infants are most commonly manifested on the skin, with an estimated frequency of 10% in the first
109 year of life (5). This tumor has rarely been reported to arise in the intracranial cavity (6). Koga et al.
110 cataloged 36 cases of intracranial capillary hemangiomas from around the world, which were
111 reported in the literature (Table. 1). Of the 36 reported cases, only 5 cases were found to be intra-
112 axial, and 3 cases were found to be in adult males (4). To the best of the author's knowledge, no
113 capillary hemangioma has been reported intra-axially within the cerebellar parenchyma.

114 Demographically, capillary hemangioma is more often found in women and occurs in young
115 adult age (7). These tumours more often manifest as benign tumours around the periorbital area,
116 rather than as lesions in the intracranial area (8). Other intracranial lesions such as
117 hemangioblastoma, where this tumour is the primary tumor in the cerebellum area, have different
118 demographic characteristics compared to capillary hemangioma (9–11). In hemangioblastoma, this

119 lesion is more common in older patients, in the age range of 60-79 years, and less frequently in
120 young adults. In contrast to capillary hemangioma, CNS hemangioblastoma is commonly found in
121 males (10).

122 It is not known whether there is a direct or indirect genetic relationship with the occurrence of
123 capillary hemangioma in the intracranial area, because this case is still very rare. However, it has
124 been found that genetic factors are involved in capillary hemangioma in extracranial locations. Some
125 of these genes, such as mutation of p.Glu70Lys and p.Trp88Ter, have a risk of causing a capillary
126 hemangioma (12). In CNS hemangioblastoma, the disease is often related or associated with Von
127 Hippel-Lindau disease, so it is related to mutations in the VHL gene, namely Exons 1, 2, and 3
128 (11,13). In addition, hemangioblastoma can also be accompanied by the involvement of other organ
129 lesions. Other vascular lesions, such as cavernoma, can be caused by mutations in the CCM1/KRIT1,
130 CCM2/MGC4607, or CCM3/PDCD10 genes (14,15). In AVM the involvement of genetic factors is
131 still unclear (16).

132 In capillary hemangioma, patients most often complain of headache (40%) as the main
133 symptom. This complaint was followed by cranial nerve palsies (30%), visual disturbances (19%),
134 nausea, vomiting (17%), seizures (13%), hydrocephalus (13%), limb motor weakness (13%), to
135 decreased consciousness (6%) (7). In our case, this patient experienced progressive headaches, and
136 motor weakness in all extremities, with the presence of hydrocephalus. Hemangioblastoma is usually
137 associated with impaired cerebellum function and signs of increased ICP, such as gait ataxia (64%),
138 dysmetria (64%), headache (12%), diplopia (8%), vertigo (8%) to vomiting (8%) (11). Other
139 vascular lesions such as AVM and cavernoma can cause clinical manifestations, especially if the
140 blood vessels involved are ruptured, ranging from bleeding and spasms, followed by headaches, and
141 neurological deficits, to nausea and vomiting (14,17).

142 Capillary hemangioma is often difficult to diagnose if only relying on radiological examination
143 because of its rarity, and the pathognomonic picture is not so clear. However, based on the literature,
144 this lesion can be suspected based on the typical radiological appearance (6,18,19). Imaging features
145 seen in cases of capillary hemangioma is an enhanced mass, giving a characteristic of high
146 vascularity. Usually, this lesion shows a homogeneous contrast enhancement. In contrast to the cases
147 we encountered, on the T1 image, there is a cystic mass lesion with heterogeneous contrast
148 enhancement and a hyperintense wall with a hypointense interior of the lesion, which can be
149 associated with intra-tumoral hemorrhage or necrosis (20). On the T2 image, multiple hypointense
150 images inside the lesion indicate the presence of flow voids.

151 Determination of the diagnosis of capillary hemangioma is usually seen based on
152 histopathological features and immunohistochemical examination. The histopathological features
153 usually found in capillary hemangiomas are a dense proliferation of numerous small blood vessels
154 with endothelial cells, lobular in shape, and some intratumoral hemorrhage (4,21). In our case, we
155 found a mass that consisted of a proliferation of capillaries, which form a lobulated structure,
156 separated by fibrocollagenous connective tissue, and a partial picture of the parent vessels in the form
157 of large capillaries. An IHC examination can be done by examining a cluster of differentiation (CD)
158 31 and CD34, which can clearly show the picture of the vascular architecture (6). In our case, IHC
159 for CD31 and S100 was performed. CD31 and S100 were positive on the endothelial and stromal
160 cells, respectively, and negative S100 on the endothelial cells. These results conclude that this
161 specimen was consistent with hemangioma, a blood vessel tumor.

162 Several cases can be used as a differential diagnosis of this case, especially the other lesions
163 involving the cerebellar parenchyma. Lesions that often arise in the cerebellum area, especially those
164 affecting adult men, can be hemangioblastomas, gliomas, or metastatic processes from other
165 locations. The three differential diagnoses are the main causes of cerebellar intra-axial tumor and
166 have several radiological features similar to the patient in our case. One way to diagnose and provide
167 appropriate therapy is to take the tumor tissue and examine the histopathological feature. In
168 hemangioblastoma, there is a well-defined cystic mass with enhancing mural nodules, accompanied
169 by neoplastic stromal cells with foamy cytoplasm and a structure of many branching small blood
170 vessels (22). We suspected this mainly because of the absence of homogeneous enhancement with
171 intravenous contrast administration and cystic appearance of the mass on MRI examination. Glioma
172 is rare in adults and more common in young children. However, the radiological picture gives a
173 characteristic picture that can indicate the possibility of glioma as the main cause of the lesion (23).
174 The metastatic process is also one of the main differential diagnoses for masses involving the
175 cerebellar area. Although this patient does not have any history of a primary tumor in another
176 location due to the high incidence of metastasized lesions in the cerebellar region, we should consider
177 this lesion's possibility. The possibility of metastases process is one of the main reasons for resection
178 and further treatment of this patient (6,24,25).

179 In general, patients with capillary hemangioma, whether total or partial resection, have a good
180 outcome. Most of the patients marked excellent improvement in neurological status. This was
181 described in a study conducted by Santoro et al, where patients who underwent total resection, found
182 an improvement in neurological status in 66% of cases and partial resection found improvement in
183 55% of cases (7). In tumours that were completely resected, no recurrence was found in all cases.

184 Patient Perspective

185 In our case, the patient initially did not seek for doctor's treatment. He felt a mild headache and
186 did not pay much attention to it. However, as the tumor grow and lead to high intracranial pressure,
187 the headache gets worsened with general weakness which prompted the patient to seek further
188 medical attention and then planned for cerebral MRI. It revealed that he had a tumor on the
189 cerebellum which compressed the CSF flow and led to hydrocephalus. The patient was advised to
190 undergo surgery for tumor removal. Initially, the patient refused and asked to negotiate first, but after
191 deliberating for 2 days the patient agreed with the action to be taken. After surgery, the patient was
192 treated in the intensive care unit for 1 day and because his condition was stable, he was then
193 transferred to the surgical ward. The motor condition and complaints of headache gradually got
194 better, until the 5th postoperative day the patient was able to walk with the help of a cane. The patient
195 was greatly helped by the operative action and appreciated the surgical team. The patient was
196 allowed to go home on the 7th postoperative day without finding any weakness in the extremities.
197 Likewise, during follow-up within the first 1 month, the patient felt that his complaints were
198 gradually improving and he was able to walk again without the help of a cane. This condition causes
199 the patient to feel grateful for the choice of therapy that has been given because the clinical condition
200 is also getting better compared to the initial conditions when admitted to the hospital.

201 **4 Conclusion**

202 Intraparenchymal cerebellar capillary hemangioma is an unusual finding. To the best of the
203 author's knowledge, no capillary hemangioma has been found in the cerebellar parenchyma as in our
204 case, neither in journals nor in other scientific literature. Although rare, lobular capillary
205 hemangioma should be one of the differential diagnoses for diagnosing intra-axial lesions in the

206 cerebellar region. Resection, followed by histopathological and IHC examination, is the necessary
207 management in determining the diagnosis of capillary hemangioma.

208 **5 Conflict of Interest**

209 The authors declare that the research was conducted in the absence of any commercial or financial
210 relationships that could be construed as a potential conflict of interest.

211 **6 Author Contributions**

212 DPWW performed the operative procedure, concepted, designed, and analyzed the manuscript
213 data. SA designed and analyzed the manuscript data. CL designed and analyzed the manuscript data.
214 RMR designed and analyzed the manuscript data. HS analyzed the manuscript data. All authors read
215 and approved the final manuscript.

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- 221 1. Daenekindt T, Weyns F, Kuan HK, Peuskens D, Engelborghs K, Wuyts J. Giant intracranial
222 capillary hemangioma associated with enlarged head circumference in a newborn: Case report.
223 J Neurosurg Pediatr. 2008 Jun;1(6):488–92.
- 224 2. Simon SL, Moonis G, Judkins AR, Scobie J, Burnett MG, Riina HA, et al. Intracranial
225 capillary hemangioma: case report and review of the literature. Surg Neurol [Internet]. 2005
226 Aug [cited 2022 Jun 24];64(2):154–9. Available from:
227 <https://pubmed.ncbi.nlm.nih.gov/16051010/>
- 228 3. Tsao MN, Schwartz ML, Bernstein M, Halliday WC, Lightstone AW, Hamilton MG, et al.
229 Capillary hemangioma of the cavernous sinus. Report of two cases. J Neurosurg [Internet].
230 2003 Jan 1 [cited 2022 Jun 24];98(1):169–74. Available from:
231 <https://pubmed.ncbi.nlm.nih.gov/12546367/>
- 232 4. Koga Y, Hamada S, Saito H, Akai T, Kuroda S. Intracranial, Intra-parenchymal Capillary
233 Hemangioma – Case Report –. NMC Case Rep J. 2020;7(2):43–6.
- 234 5. Karikari IO, Selznick LA, Cummings TJ, George TM. Capillary hemangioma of the fourth
235 ventricle in an infant. Case report and review of the literature. J Neurosurg [Internet]. 2006
236 [cited 2022 Jun 24];104(3 Suppl):188–91. Available from:
237 <https://pubmed.ncbi.nlm.nih.gov/16572636/>
- 238 6. Nepute J, Lai J, Zhou Y. Intracranial Capillary Hemangioma in the Posterior Fossa of an Adult
239 Male. Case Rep Radiol. 2016;2016:1–4.
- 240 7. Santoro G, Piccirilli M, Chiarella V, Greco N, Berra LV, Santoro A. Intracranial capillary
241 hemangiomas: literature review in pediatric and adult population. Neurosurg Rev [Internet].
242 2021 Aug 1 [cited 2023 Apr 4];44(4):1977–85. Available from:
243 <https://pubmed.ncbi.nlm.nih.gov/33079288/>
- 244 8. Bang GM, Setabutr P. Periocular Capillary Hemangiomas: Indications and Options for
245 Treatment. Middle East Afr J Ophthalmol [Internet]. 2010 [cited 2023 Apr 4];17(2):121.

- 246 Available from: [/pmc/articles/PMC2892126/](#)
- 247 9. Greenberg MS. Handbook of Neurosurgery. Handbook of Neurosurgery. 2019.
- 248 10. Yin X, Duan H, Yi Z, Li C, Lu R, Li L. Incidence, Prognostic Factors and Survival for
249 Hemangioblastoma of the Central Nervous System: Analysis Based on the Surveillance,
250 Epidemiology, and End Results Database. *Front Oncol* [Internet]. 2020 Sep 9 [cited 2023 Apr
251 4];10:570103. Available from: [/pmc/articles/PMC7509109/](#)
- 252 11. Kanno H, Kobayashi N, Nakanowatari S. Pathological and Clinical Features and Management
253 of Central Nervous System Hemangioblastomas in von Hippel-Lindau Disease. *J Kidney
254 Cancer VHL* [Internet]. 2014 Aug 5 [cited 2023 Apr 4];1(4):46. Available from:
255 [/pmc/articles/PMC5345529/](#)
- 256 12. Lee SH, Park KH, Woo SJ, Park SJ, Joo K. Clinical and Genetic Characteristics of Retinal
257 Capillary Hemangioblastoma in Korean Patients. *Korean J Ophthalmol* [Internet]. 2022 Dec 1
258 [cited 2023 Apr 4];36(6):543–9. Available from:
259 <http://www.ekjo.org/journal/view.php?number=1757>
- 260 13. Mehriani-Shai R, Yalon M, Moshe I, Barshack I, Nass D, Jacob J, et al. Identification of
261 genomic aberrations in hemangioblastoma by droplet digital PCR and SNP microarray
262 highlights novel candidate genes and pathways for pathogenesis. *BMC Genomics* [Internet].
263 2016 Jan 14 [cited 2023 Apr 4];17(1). Available from: [/pmc/articles/PMC4712606/](#)
- 264 14. Mouchtouris N, Chalouhi N, Chitale A, Starke RM, Tjoumakaris SI, Rosenwasser RH, et al.
265 Management of Cerebral Cavernous Malformations: From Diagnosis to Treatment. *Sci World
266 J* [Internet]. 2015 Jan 5 [cited 2023 Apr 4];2015. Available from: [/pmc/articles/PMC4300037/](#)
- 267 15. Choquet H, Pawlikowska L, Lawton MT, Kim H. Genetics of Cerebral Cavernous
268 Malformations: Current Status and Future Prospects. *J Neurosurg Sci* [Internet]. 2015 Sep 1
269 [cited 2023 Apr 4];59(3):211. Available from: [/pmc/articles/PMC4461471/](#)
- 270 16. Young WL, Yang GY. Are there genetic influences on sporadic brain arteriovenous
271 malformations? *Stroke* [Internet]. 2004 Nov 1 [cited 2023 Apr 4];35(11 SUPPL. 1):2740–5.
272 Available from: <https://www.ahajournals.org/doi/abs/10.1161/01.str.0000145054.35083.32>
- 273 17. Ajiboye N, Chalouhi N, Starke RM, Zanaty M, Bell R. Cerebral Arteriovenous
274 Malformations: Evaluation and Management. *Sci World J* [Internet]. 2014 [cited 2023 Apr
275 4];2014. Available from: [/pmc/articles/PMC4216697/](#)
- 276 18. Barker CS. Magnetic resonance imaging of intracranial cavernous angiomas: a report of 13
277 cases with pathological confirmation. *Clin Radiol* [Internet]. 1993 [cited 2022 Jun
278 24];48(2):117–21. Available from: <https://pubmed.ncbi.nlm.nih.gov/8004889/>
- 279 19. Willing SJ, Faye-Petersen O, Aronin P, Faith S. Radiologic-pathologic correlation. Capillary
280 hemangioma of the meninges. *Am J Neuroradiol*. 1993;14(3):529–36.
- 281 20. Mirza B, Shi WY, Phadke R, Holton JL, Turner C, Plant GT, et al. Strawberries on the brain--
282 intracranial capillary hemangioma: two case reports and systematic literature review in
283 children and adults. *World Neurosurg* [Internet]. 2013 [cited 2022 Jun 24];80(6):900.e13-
284 900.e21. Available from: <https://pubmed.ncbi.nlm.nih.gov/23247022/>
- 285 21. Morace R, Marongiu A, Vangelista T, Galasso V, Colonnese C, Giangaspero F, et al.
286 Intracranial capillary hemangioma: a description of four cases. *World Neurosurg* [Internet].
287 2012 [cited 2022 Jun 24];78(1–2):191.e15-191.e21. Available from:
288 <https://pubmed.ncbi.nlm.nih.gov/22120265/>
- 289 22. Chughtai M, Qureshi AI. Cerebellar Hemangioblastoma. *J Vasc Interv Neurol* [Internet]. 2016
290 Jan [cited 2022 Jun 24];8(5):22. Available from: [/pmc/articles/PMC4762407/](#)
- 291 23. Matsumoto H, Yoshida Y. De novo cerebellar malignant glioma: A case report. *Int J Surg
292 Case Rep* [Internet]. 2016 [cited 2022 Jun 24];22:28. Available from:
293 [/pmc/articles/PMC4844666/](#)
- 294 24. Abe M, Tabuchi K, Tanaka S, Hodozuka A, Kunishio K, Kubo N, et al. Capillary hemangioma

295 of the central nervous system. J Neurosurg [Internet]. 2004 [cited 2022 Jun 24];101(1):73–81.
 296 Available from: <https://pubmed.ncbi.nlm.nih.gov/15255254/>
 297 25. Shih RY, Smirniotopoulos JG. Posterior Fossa Tumors in Adult Patients. Neuroimaging Clin
 298 N Am [Internet]. 2016 Nov 1 [cited 2022 Jun 25];26(4):493–510. Available from:
 299 <https://pubmed.ncbi.nlm.nih.gov/27712791/>

300

301 10 Figure Legends

302 **Figure 1.** MRI shows a focal mass located in the posterior left cerebellum parenchyma. **A & B,**
 303 Contrast-enhanced **(A)** axial and **(B)** sagittal T1-weighted images. **C,** T2-weighted image showed
 304 similar intensity between the mass and cerebrospinal fluid.

305

306 **Figure 2.** Intraoperative view. The cystic contains bursting out through the corticotomy side due to
 307 high pressure.

308

309 **Figure 3.** Microscopic view. **A,** The tumor mass (black arrow), surrounded by cerebellar tissue
 310 (arrowhead) (HE stain; 40x magnifications). **B,** Branching and dilating large capillaries (black arrow)
 311 with small capillaries (arrowhead) (HE stain; 100x magnifications). **C,** The blood vessels form a
 312 lobulated structure (black arrow), surrounded by cerebellar tissue (arrowhead) (HE stain; 100x
 313 magnifications). **D,** The blood vessels are lined by a layer of flat-plump endothelial cells (black
 314 arrow) (HE stain; 400x magnifications).

315

316 **Figure 4.** The IHC results with S100 show positive results on the stromal cells (white arrow) but
 317 negative on endothelial cells (400x magnifications) (left). The CD31 shows positive results on the
 318 endothelial cells (black arrow) (400x magnifications) (right).

319 11 Table

320 **Table 1.** Reported cases of intracranial capillary hemangioma (Abbreviations: M: Male; F: Female)

	Authors	Year	Age	Sex	Origin	Treatment	Pathology
Extra-axial mass							
1	Willing et al	1993	1 year	M	Convexity	Resection	Yes
2	Watanabe et al	2001	8 years	M	Middle cranial fossa	Resection	Yes
3	Tsao et al	2003	15 years	F	Middle cranial fossa	Radiosurgery	

4	Tsao et al	2003	19 years	F	Middle cranial fossa	Radiosurgery	
5	Abe et al	2004	8 years	M	Middle cranial fossa	Resection	Yes
6	Simon et al	2005	31 years	F	Cerebellar tentorium	Resection	Yes
7	Le Bihannic et al	2005	1.5 months	M	Anterior choroidal artery	None	Yes
8	Brotchi et al	2005	10 years	F	Convexity	Resection	Yes
9	Karikari et al	2006	3 months	M	Fourth ventricle	Resection	Yes
10	Smith et al	2007	26 years	F	Middle cranial fossa	Resection	Yes
11	Uyama et al	2008	4 months	F	Convexity	Resection	Yes
12	Daenekindt et al	2008	2 months	M	Middle cranial fossa	Resection	Yes
13	Maure et al	2010	44 years	F	Convexity and middle cranial fossa	Resection	Yes
14	Lee et al	2010	59 years	F	Infundibular recess	Biopsy	Yes
15	Phi et al	2012	8 years	M	Convexity	Resection	Yes

16	Phi et al	2012	13 years	M	Cerebellar tentorium	Resection	Yes
17	Phi et al	2012	30 years	F	Cerebellar tentorium	Resection	Yes
18	Phi et al	2012	44 years	F	Ethmoid and sphenoid sinuses	Resection	Yes
19	Morace et al	2012	26 years	F	Cavernous sinus	Resection/radiation	Yes
20	Morace et al	2012	61 years	F	Cavernous sinus	Resection/radiation	Yes
21	Morace et al	2012	14 years	M	Middle cranial fossa	Resection/radiation	Yes
22	Morace et al	2012	42 years	M	Convexity	Resection	Yes
23	Zheng et al	2012	3 years	M	Middle cranial fossa	Resection	Yes
24	Mirza et al	2013	28 years	F	Cerebellar tentorium	Resection	Yes
25	Mirza et al	2013	41 years	F	Convexity	Resection	Yes
26	Jalloh et al	2014	0.5 months	M	Middle cranial fossa	Resection	Yes
27	Okamoto et al	2015	82 years	F	Convexity	Resection	Yes
28	Nepute et al	2016	40 years	M	Petrous bone	Resection	Yes

29	Xia et al	2017	33 years	F	Cerebellar tentorium	Resection	Yes
30	Low et al	2017	64 years	F	Cavernous sinus	Biopsy	Yes
¹ 31	Almaghrabi et al	2018	59 years	F	Convexity	Resection	¹ Yes

Intra-axial mass

1	Abe et al	2004	20 years	M	Subcortical	Resection	Yes
2	Abe et al	¹ 2004	16 years	F	Subcortical	Resection	Yes
3	Younas et al	¹ 2011	69 years	M	Subcortical and basal ganglia	Resection	Yes
4	¹ John et al	¹ 2012	59 years	M	Subcortical	Resection	Yes
5	Koga et al	2019	15 years	F	Subcortical	Resection	Yes
6	¹ Present case	2022	32 years	M	Subcortical	Resection	Yes

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