**Table 1. Reported cases of intracranial collision tumors in world literature**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Sl no*** | ***Author*** | ***Country*** | ***Number of cases*** | ***Age (Years)*** | ***Gender*** | ***Location of tumor*** | ***Components*** |
| 1 | Kim et al.  1997 **[1]** | South Korea | 1 | 18 | Female | CP angle mass extending to left middle cranial fossa | Schwannoma and meningioma |
| 2 | Chahlavi et al. 2005 **[2]** | USA | 1 | 67 | Male | Right posterior frontal dural-based lesion | Renal cell carcinoma and meningioma |
| 3 | Jun et al.  2006 **[3]** | USA | 1 | 56 | Female | Right frontal bilobed mass, two regions of interest, on the anterior and posterior lobes of the lesion | Typical meningioma and metastatic breast carcinoma |
| 4 | Nestler et al. 2007 **[4]** | Germany | 3 | 68 | Female; | Left cerebellar mass lesion together with a small left occipital meningioma | Glioblastoma WHO IV and meningioma |
|  |  |  |  | 72 | Female | Left parasagittal meningioma in close vicinity to a contrast-enhancing mass lesion | Transitional meningioma WHO I ˚ and glioblastoma WHO IV |
|  |  |  |  | 49 | Male | Left frontal mass lesion,  two tumors in close vicinity to each other | Fibrous meningioma WHO I˚ and a glioblastoma WHO IV |
| 5 | Palka et al. 2008 **[5]** | USA | 1 | 54 | Female | Solitary left frontal lobe lesion | Melanoma with metastatic small-cell lung cancer |
| 6 | Dewan et al.  2009 **[6]** | USA | 1 | 72 | Male | Left cerebellar hyperdense mass | Heterogeneous collision tumor composed of both metastatic esophageal carcinoma and prostate carcinoma |
| 7 | Binello et al. 2010 **[7]** | USA | 1 | 40 | Male | Right frontal convexity tumor | Collision tumor: hemangiopericytoma and meningioma |
| 8 | Gkekas et al.  2012 **[8]** | Greece | 1 | 63 | Male | Right frontal lobe | Anaplastic oligodendroglioma with meningothelial-fibrous meningioma |
| 9 | Aisner et al. 2013 **[9]** | USA | 3 | 20 | Male | Right anterior cranial fossa | PXA with low-grade glioneuronal tumor |
|  |  |  |  | 24 | Female | Left frontal lobe mass | Papillary glioneuronal tumor with PXA |
|  |  |  |  | 22 | Female | Left parieto-occipital tumor | PXA with glioneuronal tumor |
| 10 | Silveira et al. 2024 **[10]** | USA | 1 | 67 | Male | Right frontal lobe mass | Glioblastoma, isocitrate dehydrogenase wild type with subependymoma. |
| 11 | Sundarakumar et al. 2014 **[11]** | USA | 1 | 26 | Male | Posteromedial right occipital lobe, | Metastatic choriocarcinoma as a collision metastasis to the AVM. |
| 12 | Ruiz et al. 2015 **[12]** | Spain | 2 | 86 | Male | Right frontal mass | WHO grade IV glioblastoma with meningioma |
|  |  |  |  | 22 | Female | Right frontal cortico-subcortical infiltrating tumor | WHO grade III anaplastic astrocytoma with WHO grade I secretory meningioma |
| 13 | Zhang et al. 2015 **[13]** | China | 1 | 45 | Male | An intraventricular lesion, located in the left lateral ventricle trigone; | Mixed glioma (oligodendrocytes-astrocytoma) (WHO class II) and malignant meningioma (WHO class II) |
| 14 | Kochanski et al.  2016 **[14]** | USA | 1 | 79 | Female | Mass in the right parietooccipital region with apparent invasion of the underlying right parietal brain parenchyma | Papillary meningioma, WHO Grade III with anaplastic meningioma, WHO Grade III. |
| 15 | Muzumdar et al.  2015 **[15]** | India | 1 | 46 | Female | Cerebellopontine angle tumor, images suggestive of a vestibular schwannoma, a second lesion was seen in the right cerebellum | Vestibular schwannoma and tuberculoma |
| 16 | Dubovoy et al.  2017 **[16]** | Russia | 1 | 63 | Female | Right frontal region | Meningioma (meningotheliomatous variant of the structure, Grade I) and vascular cavernous malformation. |
| 17 | Kearney et al. 2017 **[17]** | Ireland | 1 | 61 | Male | Left temporal, parietal, and occipital lobes. | Anaplastic oligodendroglioma (WHO grade III) and intraventricular fibroblastic meningioma (WHO grade I). |
| 18 | Naik et al. 2018 **[18]** | India | 1 | 36 | Male | Two different locations. Subcortical region of the right frontal lobe and sellar and suprasellar region. | Anaplastic astrocytoma, grade III (WHO, 2007) and pituitary adenoma with apoplexy |
| 19 | Paolini et al. 2018 **[19]** | USA | 1 | 17 | Male | Left posterior quadrant mass abutting the dura | Atypical meningioma (WHO grade II) and CAPNON |
| 20 | Syed et al. 2018 **[20]** | USA | 2 | 71 | Male | Right parieto-occipital mass | Intraventricular meningioma component as well as a glioblastoma |
|  |  |  |  | 61 | Male | Right-sided parasagittal mass | Meningioma with intra-tumoral metastasis of patient’s adenocarcinoma (Primary lung tumor) |
| 21 | Tourne et al. 2018 **[21]** | France | 1 | 44 | Female | Right intra-axial frontal mass | Diffuse Astrocytoma and Pleomorphic Xanthoastrocytoma grade III |
| 22 | Yan et al.  2018 **[22]** | China | 1 | 50 | Male | Left-frontal cerebral falx | Extranodal NK/T cell lymphoma, nasal type colliding with meningioma |
| 23 | Zhang et al. 2018 **[23]** | China | 1 | 66 | Female | Right cerebral hemisphere | Meningioma (WHO I) and glioblastoma (GBM) |
| 24 | D’Agostino et al.  2019 **[24]** | Lebanon | 1 | 16 | Male | Right-sided non-enhancing lesion of the lateral ventricle at the foramen of Monro | Sub-ependymoma and the other DNET |
| 25 | Malli et al.  2019 **[25]** | Greece | 1 | 64 | Male | Suprasellar, not well-delineated tumor expanded into the third ventricle | Pilocytic Astrocytoma and Prolactinoma |
| 26 | Chamberlin et al.  2021 **[26]** | USA | 1 | 42 | Female | Left parieto-occipital periventricular region | Glioblastoma (WHO grade IV) and a meningioma (WHO grade I) |
| 27 | Merrill et al. 2021 **[27]** | USA | 1 | 78 | Female | Right sphenoid wing lesion. | Metastatic uterine papillary serous carcinoma and meningioma |
| 28 | Ashizawa et al. 2021 **[28]** | Japan | 1 | 46 | Female | Vermis of the cerebellum | Collision tumor of SFT/HPC and meningioma |
| 29 | Matyja et al. 2021 **[29]** |  | 1 | 31 | Female | Petro-clival region | Consisting of chordoma and meningioma |
| 30 | Lin et al.  2022 **[30]** | Taiwan | 1 | 56 | Female | Large left frontal brain mass | Clear cell atypical meningioma (WHO grade II) with IDH-mutant glioblastoma |
| 31 | Zacharewski et al.  2022 **[31]** | USA | 1 | 72 | Female | Left parasagittal region, posterior frontoparietal and occipital areas | De Novo Glioblastoma with Meningioma |
| 32 | Nedeljkovic et al.  2023 **[32]** | Serbia | 1 | 17 | Male | Right frontal lobe closely related to dura | Ganglioglioma (WHO gr-I) and supratentorial ependymoma (WHO gr-III) |
| 33 | Sobstyl et al. 2023 **[33]** | Poland | 1 | 64 | Male | Right hemisphere | GB, IDH-wildtype, CNS WHO G4 with meningothelial meningioma, CNS WHO G1 |

**References**

1. Kim DG, Paek SH, Chi JG, Chun YK, Han DH. Mixed tumour of schwannoma and meningioma components in a patient with NF-2. Acta Neurochir (Wien). 1997;139(11):1061-4; discussion 1064-5
2. Chahlavi A, Staugaitis SM, Yahya R, Vogelbaum MA. Intracranial collision tumor mimicking an octreotide-SPECT positive and FDG-PET negative meningioma. J Clin Neurosci. 2005;12(6):720-3
3. Jun P, Garcia J, Tihan T, McDermott MW, Cha S. Perfusion MR imaging of an intracranial collision tumor confirmed by image-guided biopsy. AJNR Am J Neuroradiol. 2006;27(1):94-7
4. Nestler U, Schmidinger A, Schulz C, Huegens-Penzel M, Gamerdinger UA, Koehler A, Kuchelmeister KW. Glioblastoma simultaneously present with meningioma--report of three cases. Zentralbl Neurochir. 2007;68(3):145-50
5. Palka KT, Lebow RL, Weaver KD, Kressin MK. Intracranial collision metastases of small-cell lung cancer and malignant melanoma. J Clin Oncol. 2008;26(12):2042-6
6. Dewan S, Alvarez VE, Donahue JE, Cielo D. Intracranial collision metastases of prostate and esophageal carcinoma. J Neurooncol. 2009;95(1):147-150
7. Binello E, Bederson JB, Kleinman GM. Hemangiopericytoma: collision with meningioma and recurrence. Neurol Sci. 2010;31(5):625-30
8. Gkekas N, Georgakoulias N, Kakiopoulos G, Seretis A. De novo intracranial collision tumour in previously evacuated intracerebral haematoma site. Br J Neurosurg. 2012;26(6):880-1
9. Aisner DL, Newell KL, Pollack AG, Kleinschmidt-Demasters BK, Steinberg GK, Smyth LT, Vogel H. Composite pleomorphic xanthoastrocytoma-epithelioid glioneuronal tumor with BRAF V600E mutation - report of three cases. Clin Neuropathol. 2014;33(2):112-21
10. Silveira LA, Abraham B, Wicks E, Thakrar R, Delahmetovic E, Callahan K, DeWitt J, Tranmer B, Liebelt B. Sentinel report of uniquely paired collision tumors: glioblastoma multiforme and coexistent intraventricular subependymoma. Illustrative case. J Neurosurg Case Lessons. 2024;7(11):CASE2423
11. Sundarakumar DK, Marshall DA, Keene CD, Rockhill JK, Margolin KA, Kim LJ. Hemorrhagic collision metastasis in a cerebral arteriovenous malformation. J Neurointerv Surg. 2015;7(10):e34
12. Ruiz J, Capilla E, Díaz JF, Ruiz JA, Andrade J, Hernández T, Mollejo M, Meléndez B. Secretory meningioma with KLF4 K409Q mutation in collision with glioma. Clin Neuropathol. 2015;34(6):322-9.
13. Zhang D, Yu J, Guo Y, Zhao S, Shao G, Huang H. An intraventricular meningioma and recurrent astrocytoma collision tumor: a case report and literature review. World J Surg Oncol. 2015 12;13:37
14. Kochanski RB, Byrne N, Arvanitis L, Bhabad S, Byrne RW. A rare intracranial tumor consisting of malignant anaplastic and papillary meningioma subtypes. Surg Neurol Int. 2016;7:21
15. Muzumdar D, Mahore A, Ramdasi R, Bhatjiwale M. Vestibular schwannoma and tuberculoma occurring In collision in the posterior fossa: A case report. Int J Surg Case Rep. 2016;19:75-7
16. Dubovoy AV, Jafarov VM, Voronina EI. Supratentorial dural-based collision of cavernoma and meningioma: a case report. Chin Neurosurg J. 2018;4:17
17. Kearney H, Cryan JB, Looby S, Brett FM, Farrell MA, Buckley PG. The DNA copy number landscape of a collision tumor. Clin Neuropathol. 2018;37(2):68-73
18. Naik H, Vernon V, Gade P, Bhople L, Guha A. Anaplastic astrocytoma and pituitary macroadenoma within the same patient: A rare case of intracranial collision tumor. Neurol India. 2018;66(3):857-860
19. Paolini MA, Ho ML, Monahan HR, Raghunathan A. Supratentorial CAPNON associated with WHO grade II meningioma: A case report. Neuropathology. 2018;38(5):535-538
20. Syed S, Karambizi DI, Baker A, Groh DM, Toms SA. A Comparative Report on Intracranial Tumor-to-Tumor Metastasis and Collision Tumors. World Neurosurg. 2018; 116:454-463.e2
21. Tourne M, Tauziède-Espariat A, Dezamis E, Saffroy R, Dhermain F, Chrétien F, Varlet P. Combined Diffuse Astrocytoma and Pleomorphic Xanthoastrocytoma Grade III Sharing IDH1 R132H Mutation. World Neurosurg. 2018;116:316-321
22. Yan J, Liu W, Wang X, Zhao S, Gao L, Ye Y, Lei X, Long Y, Ji J, Zhang W. Primary Central Nervous System Extranodal Natural Killer/T-Cell Lymphoma, Nasal Type Colliding with Meningioma. World Neurosurg. 2018;120:17-26
23. Zhang Z, Yang Y, Zhang K, Zhuang J, Shao F, Liu H, Xing Y, Xu S. Collision Tumor of Glioblastoma and Meningioma: Case Report and Literature Review. World Neurosurg. 2018;117:137-141
24. D'Agostino E, Calnan DR, Hickey W, Bauer DF. Subependymoma and dysembryoplastic neuroepithelial collision tumor in the foramen of Monro: case report. J Neurosurg Pediatr. 2019;23(6):732-736
25. Malli A, Melissaris S, Dimitriadi A, Choreftaki T, Georgakoulias N. A Coexisting Pilocytic Astrocytoma and a Prolactinoma: A Case Report of Collision Tumors and Literature Review. Cureus. 2019;11(6):e4911
26. Chamberlin K, Chamberlin G, Saunders K, Khagi S. Next-generation sequencing reveals novel mutations in a collision tumor of glioblastoma and meningioma. CNS Oncol. 2021;10(2):CNS70
27. Merrill SA, Sharma A, Carlin RE, McCullough AE, Porter AB, Bendok BR, Kouloumberis PE. A Rare Intracranial Collision Tumor of Meningioma and Metastatic Uterine Adenocarcinoma: Case Report and Literature Review. World Neurosurg. 2021; 145:340-347
28. Ashizawa K, Ogura K, Nagase S, Sakaguchi A, Tokugawa J, Hishii M, Fukunaga M, Hirose T, Matsumoto T. A collision tumor of solitary fibrous tumor/hemangiopericytoma and meningioma: A case report with literature review. Pathol Int. 2021;71(10):697-706
29. Matyja E, Wójtowicz K, Kunert P, Marchel A, Grajkowska W. Chordoma and meningioma arising as a collision tumor in the petroclival region: Case report and literature review. Clin Neuropathol. 2021;40(3):134-141
30. Lin MS, Lee CH, Chen SY, Shen CC. Collision brain tumor with atypical meningioma and glioblastoma: Case report. Int J Surg Case Rep. 2022 ;94:107137
31. Zacharewski N, Movahed-Ezazi M, Song X, Mehta T, Manjila S. De Novo Glioblastoma Masqueraded within a Hemispheric Dural Meningiomatosis: Rare Imaging Findings and Rationale for Two-Staged Resection. J Neurol Surg Rep. 2022;83(2):e44-e49
32. Nedeljkovic A, Ilic R, Nedeljkovic Z, Milicevic M, Raicevic S, Grujicic D. A unique case of intracranial collision tumor composed of ganglioglioma WHO gr I and supratentorial ependymoma WHO gr III: case-based literature review. Childs Nerv Syst. 2023; 39(9):2407-2411
33. Sobstyl M, Nagańska E, Glinka P, Wierzba-Bobrowicz T, Acewicz A, Kuls-Oszmaniec A. Large haemorrhage within glioblastoma mimicking haemorrhagic stroke and coexistance of meningioma: a case of collision tumours. Folia Neuropathol. 2023;61(4):433-441.