

# Preoperative Embolization of Hemangioblastomas

Sirakov S.<sup>1</sup>, Penkov M.<sup>2</sup>, Sirakov A.<sup>3</sup>, Minkin K.<sup>4</sup>, Ninov K.<sup>5</sup>

University Hospital "Sv Ivan Rilski", Medical University - Sofia

**Abstract:** ***Background:** Hemangioblastomas are benign and highly vascular tumors. The high morbidity and mortality rate is associated with uncontrolled hemorrhage during surgery. Preoperative embolization of these tumours may facilitate surgical treatment. **Aim:** the aim of this study is to share authors experience of embolization of hemangioblastomas before surgical resection. **Methods and material:** 8 patients (5 women and 3 men) aged 27 to 62, with hemangioblastomas. Tumours are evaluated by MRI and preprocedureangiography. Onyx is used as embolic agent. **Results:** 5 out of 8 of the patients underwent subtotal embolization in and 3 - a total embolization. No complications occurred during the endovascular embolization. Surgeons reported significantly no or less intraoperative bleeding. **Conclusions:** The preoperative embolization of hemangioblastomas is a useful and relatively safe procedure, that potentially reduces morbidity and mortality during surgical resection*

**Keywords:** endovascular, embolisation, hemangioblastomas, preoperative, surgical resection

## 1. Introduction

Hemangioblastomas are benign and highly vascular tumours. They represent 1.1 to 2% of all craniospinal neoplasms. The hypervascular tumour nidus may be associated with a cyst, which further impedes the excision of these excessive bleeding tumors. The treatment of such tumour types containing mural nodules such as hemangioblastoma is total resection. However, as this lesion usually originates in the posterior cranial fossa and due to the presence of many tumour vessels, excessive arterial bleeding is observed in the operative field, making it hard to perform a total resection. Performing preoperative embolization of these tumors, the percentage of total resection increases significantly, facilitating surgeon's work.

## 2. Aim

The aim of this study is to share authors experience of embolization of hemangioblastomas before surgical resection.

## 3. Materials and Methods

8 patients (5 women and 3 men) aged 27 to 62, diagnosed with hemangioblastomas have undergone the preoperative embolization. Each patient was performed a MRI examination with tumor visualization.

General anesthesia was given to all patients having embolization.

A catheterization of the right femoral artery was performed by Seldinger technique. A digital subtraction cerebral panangiography was performed. After visualization and assessment of the tumour structure and anatomical expansion we proceeded to selective catheterization of the pathological tumour vessels. Subtotal embolization was performed in 5 of the patients and 3 of the patients undergone a total embolization using the non-adhesive embolic agent Onyx. All patients underwent the preoperative embolization have to be monitored within the first 72 hours and intravenous steroids must be administered, due to the high risk of tumor "swelling", perifocal edema enlargement,

and intracranial pressure increased. After the 72 hours the surgical excision should be performed.

## 4. Cases Presentation

### Case 1:

A 42-year-old woman presented with a history of progressive headache. Brain MRI revealed a Tumour located in the posterior fossa, showing significant enhancement with multiple signal void of the postcontrast images. (Fig. 1 and 2)

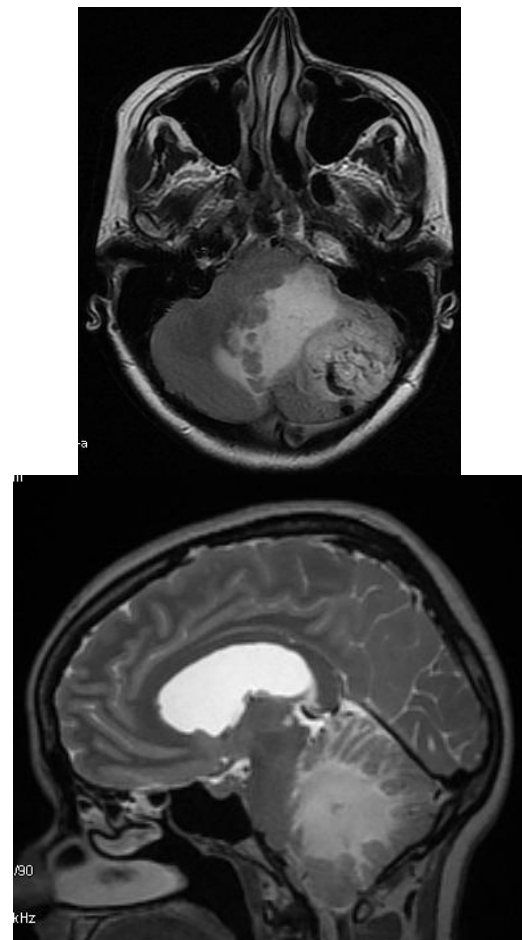


Figure 1: Brain MRI – T2 series with visualization of wide cerebral edema and presence of intraaxial tumour

The differential diagnosis included hemangioblastoma, metastasis and primary glial Tuwith high malignancy grade (glioma).

The diagnostic vertebral angiogram demonstrated a significant vascular blush supplied of the lesion mostly from branches of the left PICA, which directly fills the tumor with contrast media(a sign that diagnosis the hemangioblastoma).

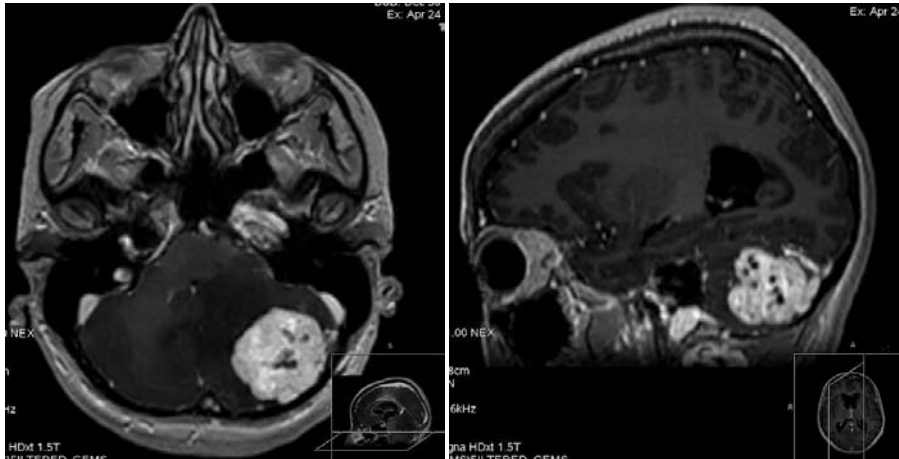


Figure 2: Contrast-enhanced T1-weighted images of highly enhancing tumour.

A conventional angiography was carried out, which visualized and confirmed the anatomical vessel tumor characteristic.

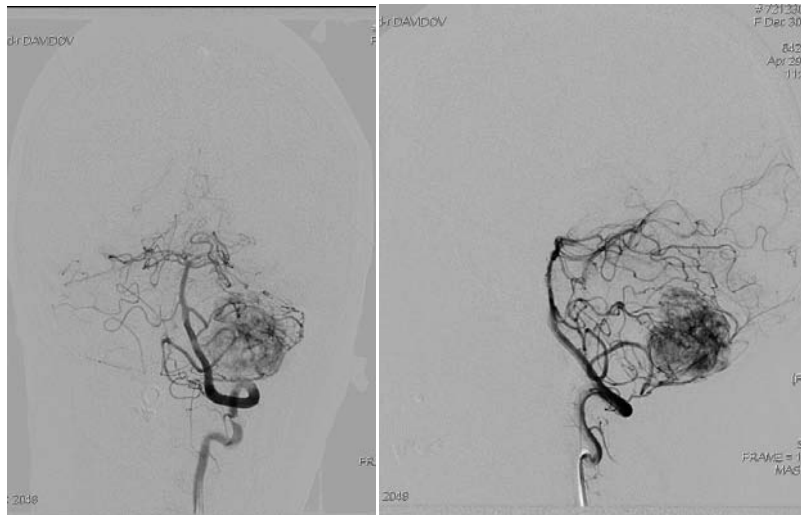


Figure 3: A diagnostic angiogram of the left vertebral artery revealing pathological tumor vasculature.

A preoperative embolization of the hemangioblastoma was performed as total obliteration of the Tuvascularbed was achieved.

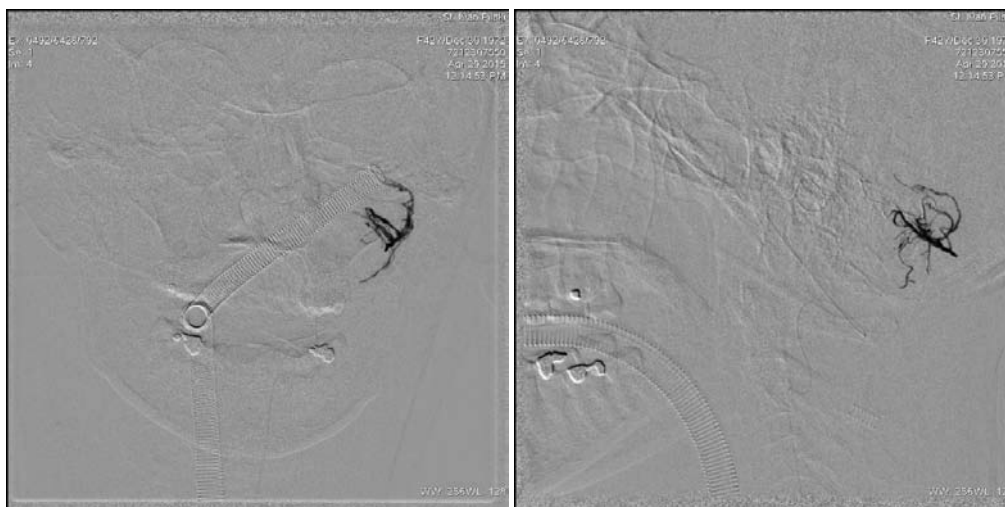


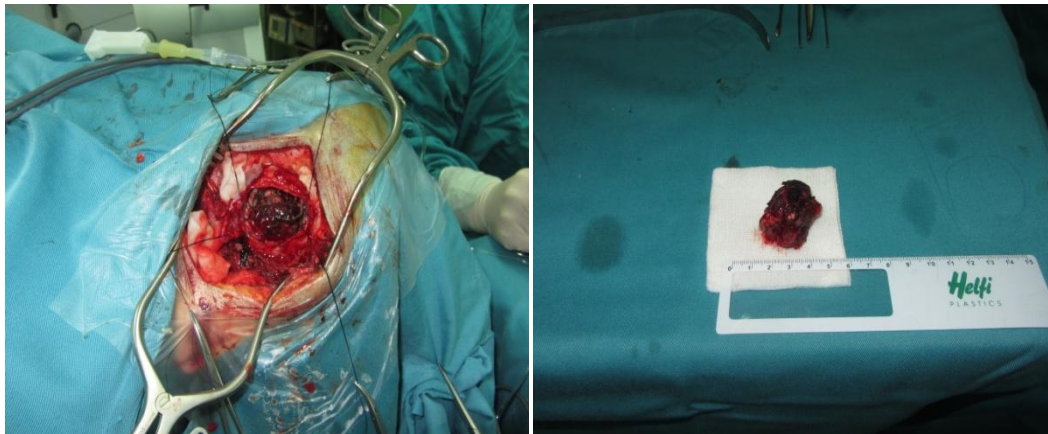
Figure 4: Selective catheterization of tumorvasculature.The microcatheter was projected with a peak at the center of the tumor formation.

The total embolized pathological vasculature is visualized at the final angiography.



**Figure 5:** A control angiography at the end of the procedure without presence of contrast media in the tumor vasculature.

Subsequently, a total tumor resection was performed with very good control of intraoperative bleeding and subsequent histological verification.

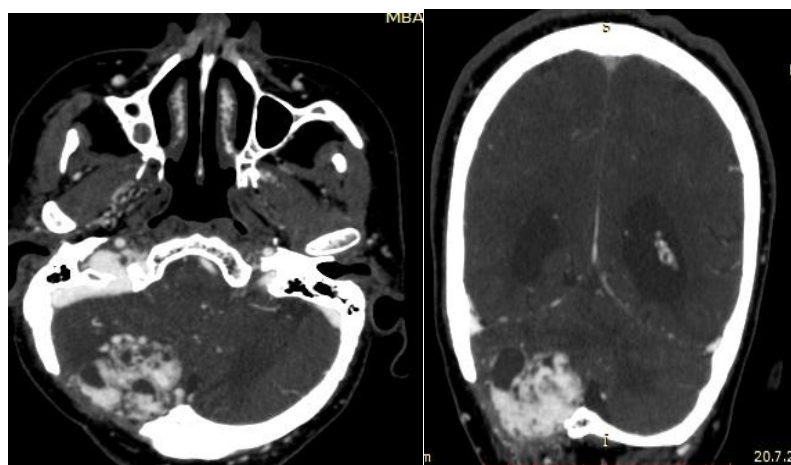


**Figure 6:** A photograph from the carried out surgical intervention and the extirpated tumor.

**Case 2:**

A 62-year-old man presented with a history of two performed surgical interventions and partial tumor resections (due to uncontrolled intraoperative bleeding).

A residual Tu, infratentorial on the right was visualized by the realized CT with contrast media.



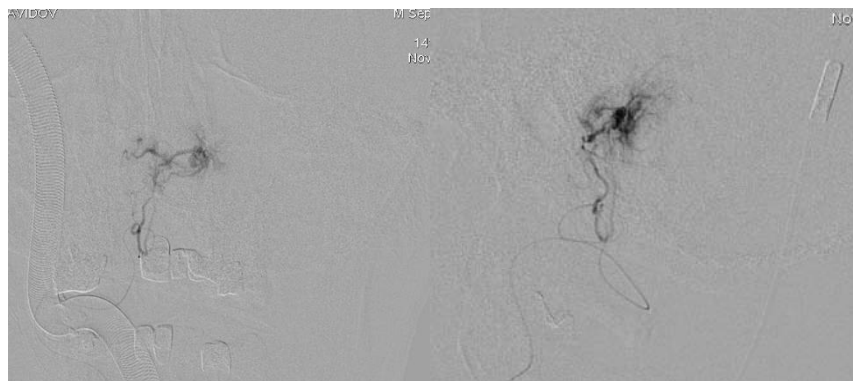
**Figure 7:** A CT revealed the contrast residual tumor.

A conventional angiography was carried out, which visualized the tumor vascular bed.



**Figure 8:** A diagnostic angiography revealed the anatomical tumor characteristic.

This patient underwent subtotal tumor embolization.



**Figure 9:** Selective angiography, themicrocatheter was projected with a peak at the tumor bed.

A partial filling of the tumor vasculature is visualized at the final angiography by the contrast media.



**Figure 10:** A control angiographyat the end of the procedurerevealing subtotal tumor vasculature embolization.

Subsequently, a total tumor resection was performed with significantly reduced bleeding during the surgery and better control by the operator.

## 5. Results

There were no complications reported during the endovascular embolization performance. One female patient had aggravation of clinical symptoms after the performed embolization (perifocal oedema aggravation), which did not require subsequent surgical intervention. In the subsequent operative excision, surgeons reported significantly less or no bleeding at all in all treated patients. In some patients minimal bleeding was observed mainly from small peripheral vessels entering towards the tumour bed. After the performed preoperative tumor embolization a total resection was carried out in 7 of the patients, but the surgical intervention had to be postponed for one of the patients due to significant increase in the perifocal edema after embolization and worsening of clinical symptoms.

Two of the patients, who had a history of surgical intervention, underwent a subsequent total resection with good control of the intraoperative bleeding.

In all preoperative embolized patients nearly avascular tumour mass is reported with the presence of single small vessels entering peripheral towards the tumour bed, that required additional intraoperative control. Neurosurgeons reported that the tumor nidus devascularization allows easy treatment and performing a total resection.

## 6. Discussion

Hemangioblastomas are benign, usually highly vascular tumors of the central nervous system. It occurs most often in the cerebellum where it is most common primary neoplasm in adults (Slater, Moore et al. 2003) (Agrawal, Kakani et al. 2010). Multiple tumours are almost associated with von Hippel-Lindau disease (Slater, Moore et al. 2003). Due to their location and anatomical structure these tumors can be difficult for total excision. In carrying out the preoperative embolization of the tumor vascular bed, the intra-operative control is facilitated, the blood loss during the excision is reduced and the chances of total tumor resection are increased. Histologically and radiologically hemangioblastomas are traditionally described in four types: simple cyst without macroscopic nodule, cyst with mural nodule (up to 60%), solid tumours and solid tumours with small internal cysts (Lee, Sanches et al. 1989; Slater, Moore et al. 2003).

Different approaches are used in embolization of hemangioblastomas. Hypervascular tumour nidus was devascularized with polyvinyl alcohol particles by Eskridge and coll (Eskridge, McAuliffe et al. 1996). Murai and coll used N-butyl cyanoacrylate (NBCA) (Murai, Kominami et al. 2012). Cornelius and coll reported embolization with Embosphere particles (trisacrylgelatin micro-spheres). The smallest particle diameter ranged from 100 to 300 microns. The outcome of embolization was favorable in patients with spinal cord hemangioblastomas, but it was unfavorable for those with cerebellar

hemangioblastomas; acute tumor bleeding occurred (Cornelius, Saint-Maurice et al. 2007). Nowadays Onyx is used as embolic agent. Animal experimental studies of endovascular delivery of ethylene vinyl alcohol copolymer are reported (Gobin, Murayama et al. 2001). Gore and coll reported the specific technical advantages of Onyx included deep penetration of lesions producing extensive tumour infarction, the ability to embolize extensive portions of the tumours through fewer arterial catheterizations, and the safety of catheter withdrawal despite often substantial reflux along the embolic catheter (Gore, Theodore et al. 2008). Different experience is reported in the literature (Montano, Doglietto et al. 2008). The recently reported cases of embolization of hemangioblastoma with a non-adhesive liquid embolic agent (Onyx) are not extensive but more and more in clinical use promising (Horvathy, Hauck et al. 2011; Dabus, Pryor et al. 2013). The lowest number of complications in our series confirm that the safety and effectiveness of this procedure are promising.

**In conclusion**, the preoperative embolization of hemangioblastomas is a useful and relatively safe procedure, that potentially reduces morbidity and mortality during surgical resection.

## References

- [1] Agrawal, A., A. Kakani, et al. (2010). "Cystic hemangioblastoma of the brainstem." *J Neurosci Rural Pract* 1(1): 20-22.
- [2] Cornelius, J. F., J. P. Saint-Maurice, et al. (2007). "Hemorrhage after particle embolization of hemangioblastomas: comparison of outcomes in spinal and cerebellar lesions." *J Neurosurg* 106(6): 994-998.
- [3] Dabus, G., J. Pryor, et al. (2013). "Embolization of intra-axial hypervascular tumors with Onyx: report of three cases." *J Neurointerv Surg* 5(2): 177-180.
- [4] Eskridge, J. M., W. McAuliffe, et al. (1996). "Preoperative endovascular embolization of craniospinal hemangioblastomas." *AJNR Am J Neuroradiol* 17(3): 525-531.
- [5] Gobin, Y. P., Y. Murayama, et al. (2001). "Head and neck hypervascular lesions: embolization with ethylene vinyl alcohol copolymer--laboratory evaluation in Swine and clinical evaluation in humans." *Radiology* 221(2): 309-317.
- [6] Gore, P., N. Theodore, et al. (2008). "The utility of onyx for preoperative embolization of cranial and spinal tumors." *Neurosurgery* 62(6): 1204-1211; discussion 1211-1202.
- [7] Horvathy, D. B., E. F. Hauck, et al. (2011). "Complete preoperative embolization of hemangioblastoma vessels with Onyx 18." *J Clin Neurosci* 18(3): 401-403.
- [8] Lee, S. R., J. Sanches, et al. (1989). "Posterior fossa hemangioblastomas: MR imaging." *Radiology* 171(2): 463-468.
- [9] Montano, N., F. Doglietto, et al. (2008). "Embolization of hemangioblastomas." *J Neurosurg* 108(5): 1063-1064; author reply 1064-1065.
- [10] Murai, Y., S. Kominami, et al. (2012). "Preoperative liquid embolization of cerebellar hemangioblastomas using N-butyl cyanoacrylate." *Neuroradiology* 54(9): 981-988.

- [11] Slater, A., N. R. Moore, et al. (2003). "The natural history of cerebellar hemangioblastomas in von Hippel-Lindau disease." AJNR Am J Neuroradiol24(8): 1570-1574.
- [12] Standard, S. C., A. Ahuja, et al. (1994). "Endovascular embolization and surgical excision for the treatment of cerebellar and brain stem hemangioblastomas." Surg Neurol41(5): 405-410