Clinical Neurology and Neurosurgery 174 (2018) 180–184

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

Prognostic risk factors for postoperative hemorrhage in stereotactic biopsies of lesions in the basal ganglia

Dana Farahmand[a,b,c], Fee Keil[b], Marie Göhring[c], Nazife Dinc[a], Volker Seifert[a], Gerhard Marquardt[a], Sae-Yeon Won[a,1], Johanna Quick-Weller[a,*,1]

[a] Department of Neurosurgery, Goethe University, Frankfurt, Germany
[b] Institute for Neuroradiology, University Hospital, Goethe University, Frankfurt am Main, Germany
[c] Department for Anesthesiology, Goethe University, Frankfurt, Germany

ARTICLE INFO

Keywords:
Stereotactic biopsy
Hemorrhage
Basal ganglia
Frame guided

ABSTRACT

Objective: The risk of hemorrhages after stereotactic biopsy is known to be low. Nevertheless hemorrhages in eloquent areas result in neurological deficit for the patients. Since the basal ganglia resemble a particularly high vascularized and eloquent location, which is often the source of hypertensive hemorrhages, we aimed to analyse possible risk factors for hemorrhage after stereotactic biopsy in this region.

Patients and methods: We performed a retrospective analysis including patients who underwent stereotactic biopsies of lesions in the basal ganglia between January 2012 and January 2017.

63 patients were included in this study. We accessed age, gender, histopathological diagnosis, hypertension, blood pressure intraoperative, anticoagulative medication and postoperative hemorrhage.

Results: Fishers exact test revealed no significant p-values concerning anticoagulative therapy, gender, smoking and hypertension concerning postoperative hemorrhage. Wilcoxon-Mann-Whitney-Test showed no significant correlation for systolic blood pressure intraoperative, number of tissue samples and age with hemorrhage.

A trend for lymphoma in correlation with postoperative hemorrhage was in patients with Lymphoma (Wilcoxon-Mann-Whitney Test).

Conclusion: Stereotactic biopsies even in eloquent areas as the basal ganglia are a safe procedure even if patients suffer under hypertension or are smoker. None of the here examined risk factors showed a significant correlation with postoperative hemorrhage.

Accessing tumor tissue for histopathological diagnosis is mandatory for adequate therapy.

1. Introduction

Nowadays, stereotactic biopsies are performed on an every day routine in many neurosurgical departments. Since exact tumor grading combines histopathological and molecular analysis, the assessment of tumor tissue is inevitable.

While imaging techniques have tremendously improved over the last years, final diagnosis can still only be established after tumor tissue has been examined. In 90% of cases the pathologist can establish an accurate diagnosis by performing histopathologic, molecular, and immunologic analysis [1]. The further treatments of the patient, such as radiotherapy, chemotherapy or resection are based on these results.

The procedure itself can be performed frame-based or frame-less and patients can undergo the procedure under local or general anesthesia [2–4]. It remains unclear whether local or general anesthesia is less stressful for the patient and whether frame-guided or frame-less procedures offer more safe. Even if the stereotactic biopsy is performed frame-less the procedure can be conducted under local anesthesia in combination with conscious sedation [5].

Although the procedure itself goes in hand with a very low complication risk, every surgeon is afraid of causing postoperative hemorrhage especially in eloquent and highly vascularized regions such as the basal ganglia. Furthermore, many tumors are highly vascularized. Studies have shown so far that even eloquent regions like the brainstem and cerebellar can be reached stereotactically with maximum safety and even children can undergo the procedure [6–8].

Not only the brainstem but also the basal ganglia represent a deep seated and eloquent region. It resembles a predestination for

* Corresponding author at: Department of Neurosurgery, University Hospital, Schleusenweg 2-16, 60528, Frankfurt am Main, Germany.
E-mail address: johanna.quick@gmx.de (J. Quick-Weller).
[1] Both authors contributed equally.

https://doi.org/10.1016/j.clineuro.2018.09.008
Received 25 July 2018; Received in revised form 26 August 2018; Accepted 3 September 2018
Available online 18 September 2018
0303-8467/

hypertensive hemorrhages and irresectable tumors are often seated in the basal ganglia [9,11]. To access tumor tissue they can only be reached by stereotactic biopsy. We evaluated whether lesions in this location have a higher risk of postoperative hemorrhage and whether this risk goes in hand with a history of hypertension, smoking, gender, age or elevated intraoperative blood pressure.

Since patient population grows older diseases of the elderly are common also in patients who undergo stereotactic biopsy. Quick-Weller et al. showed that also elderly patients aged 80 years and older want to be treated even if a malignoma is histologically proven [10]. Therefore it is important for the surgeon to know whether his patient shows a higher risk of postoperative hemorrhage and might require post-operative CT scan and monitoring.

2. Patients and methods

We performed a retrospective analysis of our database and included patients who underwent stereotactic biopsy of lesions in the basal ganglia between January 2012 and January 2017. 514 patients underwent stereotactic biopsy at our department during this five years period, among these were 63 who underwent biopsy of lesions in the basal ganglia. We only included patients who underwent the procedure for diagnostic reasons. Patients who underwent cyst puncture or puncture of hemorrhages were excluded from this study.

We evaluated age, gender, hypertension, blood pressure levels intraoperative, history of smoking, anticoagulation and histopathological diagnosis in correlation to postoperative bleeding as possible prognostic factors. In the patients with preoperative anticoagulative therapy, medication was paused 7–10 days before surgery.

Every stereotactic procedure was performed frame-based (Leksell Frame). Trajectory planning was performed using BrainLab iPlan software 2.0 (BrainLab, Munich, Germany).

3. Description of the procedure

All patients underwent thin slice MRI with contrast media in advance. On the day of the surgery all patients underwent CT with the frame attached to their heads. Leksell frame was attached with two pins frontal and two pins occipital. CT and MRI imaging were then fused and a trajectory was calculated by using BrainLab iplan software 2.0 (Brainlab, Munich, Germany). The trajectory was planned from right or left frontal, if possible in order to avoid eloquent structures. All parameters were then applied to the frame. Skin incision was about 2.5 cm long and the burrhole was about 1 cm in diameter. After the dura mater has been coagulated the dura was incised. Tissue samples were taken with a biopsy forceps, which generates samples of 1 mm. During every procedure a neuropathologist was present. He confirmed, that tumor tissue has been taken therefore the surgeon was sure to have reached the lesion of pathological tissue.

After confirmation, the biopsy forceps is drawn back and the skin was closed.

The frame was detached from the head and the anesthesia ended. After the procedure the patient was brought to the recovery room and finally to the normal ward (Table 1).

4. Results

Median age of the included patients was 57. 28 (44.4%) patients were female and 35 (55.6%) patients male.

In all patients a definitive diagnosis was be established. Median number of tissue samples taken was 15. Histopathological analysis revealed glioblastoma in 31 patients (49.2%), lymphoma was diagnosed in 14 patients (22.2%), astrocytoma WHO I in 3 (4.8%), astrocytoma WHO II in 5 (7.9%) and astrocytoma WHO III in 3 patients (4.8%). In also 3 patients (4.8%) metastases was diagnosed. Toxoplasmosis, encephalopathia, gliosis and gliosarkoma were diagnosed in one patient each.

Table 1
Overview of patient characteristics.

Variable	All STX (n = 63)	No bleeding (n = 46)	ICH < 1 cm (n = 11)	ICH > 1 cm (n = 6)
Gender				
female	28 (44.4)	19 (41.3)	6 (54.5)	3 (50)
male	35 (55.6)	27 (58.7)	5 (45.5)	3 (50)
Anticoagulative therapy				
no anticoagulation	48 (76.2)	33 (71.7)	10 (90.9)	5 (83.3)
Aspirin	11 (17.5)	9 (19.6)	1 (9.1)	1 (16.7)
Phenprocumon	2 (3.2)	2 (4.3)	0	0
Plavix	0			
Rivaroxaban	1 (1.6)	1 (2.2)		
Kombi	1 (1.6)	1 (2.2)		
Smoking				
yes	12 (19)	7 (15.2)	3 (27.3)	2 (33.3)
no	22 (34.9)	17 (37)	3 (27.3)	2 (33.3)
unsure	29 (46)	22 (47.8)	5 (45.5)	2 (33.3)
Hypertension				
yes	27 (42.9)	16 (34.8)	7 (63.6)	4 (66.7)
no	36 (57.1)	30 (65.2)	4 (36.4)	2 (33.3)
Histopathological diagnosis				
GBM	31 (49.2)	23 (50)	5 (45.5)	3 (50)
Lymphoma	14 (22.2)	7 (15.2)	5 (45.5)	2 (33.3)
Astrocytoma I	3 (4.8)	3 (6.5)		
Astrocytoma II	5 (7.9)	5 (10.9)		
Astrocytoma III	3 (4.8)	3 (6.5)		
Metastasis	3 (4.8)	2 (4.3)	1 (9.1)	
Others	4 (6.3)	3 (6.5)		1 (16.7)
Age				
< 57	31 (49.2)	24 (52.2)	3 (27.3)	4 (66.7)
=57	2 (3.2)	1 (2.2)	1 (9.1)	
> 57	30 (47.6)	21 (45.7)	7 (63.6)	2 (33.3)
Number of tissue samples				
< 15	29 (46)	21 (45.7)	4 (36.4)	4 (66.7)
= 15	6 (9.5)	4 (8.7)	2 (18.2)	
> 15	28 (44.4)	21 (45.7)	5 (45.5)	2 (33.3)

Postoperative hemorrhage was found in 17 patients. 6 of these hemorrhages had a mass effect, which was definined as > 1 cm [3].

Fisher's exact test was used to correlate gender, anticoagulative therapy, smoking and hypertension. P-values of 0.05 and below were considered statistically significant. Analysis of the above mentioned parameters revealed no significant p-values (gender p = 0.6, anticoagulative therapy p = 0.5, smoking p = 0.6, histopathological diagnosis p = 0.6, Glioblastoma versus other histopathological diagnosis p = 1,0 and for Lymphoma versus other histopathological diagnosis p = 0.06).

For age, number of tissue samples and systolic intraoperative blood pressure Wilcoxon-Mann-Whitney Test for non- parametric values was used. P-value for age was 0.4, for numbers of tissue samples taken p values was 0.5 and for intraoperative systolic blood pressure p was also 0.5. An overview of the statistical evaluation can be found in Table 2.

13 Patients (20.6%) showed clinical worsening postoperative

Table 2
Overview of the statistical analysis for possible risk factors.

Riskfactors	P-Values
Gender	n.s. (0.6)
Anticoagulative Therapy	n.s. (0.5)
Smoking	n.s. (0.6)
Hypertension	n.s. (0.5)
Histopathological Diagnosis	n.s. (0,1) (0.6/1.0)
Age	n.s. (0.4)
Number of tissue samples	n.s. (0.5)