Clinical Neurology and Neurosurgery 166 (2018) 10–15

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

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

The stereotactic suboccipitaltranscerebellar approach to lesions of the brainstem and the cerebellum☆

Julia M. Nakagawa[a,e], Michael Trippel[b,e], Soroush Doostkam[c,e], Irina Mader[d,e], Volker A. Coenen[b,e], Peter C. Reinacher[b,e,*]

[a] Department of Neurosurgery, Medical Center - University of Freiburg, Germany
[b] Departmentof Stereotactic and Functional Neurosurgery, Medical Center - University of Freiburg, Germany
[c] Institute of Neuropathology, Medical Center - University of Freiburg, Germany
[d] Department of Neuroradiology, Medical Center - University of Freiburg, Germany
[e] Faculty of Medicine, University of Freiburg, Germany

ARTICLE INFO

Keywords:
Stereotactic
Suboccipital approach
Transcerebellar approach
Stereotactic biopsy

ABSTRACT

Objective: The stereotactic suboccipital-transcerebellar approach is widely regarded as technically demanding requiring substantial modifications of the standard stereotactic methods thus often making a transfrontal approach preferable.

In this comprehensive series we aim to present our experience with the stereotactic suboccipital-transcerebellar approach to lesions of the brainstem or cerebellum using two standard stereotactic systems.

Patients and Methods: In the period of 2000–2015 overall 80 patients (mean age 43.95 ± 23.76 years) with lesions of the brainstem or cerebellum underwent stereotactic surgery for diagnostic or therapeutic purposes via a suboccipital approach. In 59 patients stereotactic surgery was performed using the Riechert-Mundinger Stereotactic Frame, the Leksell Stereotactic Frame was used in 21 patients. For both frames standard systems were used without modification. Retrospective analysis of intraoperative stereotactic technique, achievement of the predefined surgical objectives and perioperative complications was carried out.

Results: In this series, the stereotactic suboccipital-transcerebellar approach proved to be feasible with two standard stereotactic systems. Using either frame the predefined surgical objective was achieved in 90.0%. A verified neuropathological diagnosis was obtained in 89.6%. Minor transient perioperative complications occurred in 8.75%. There was no surgery-related permanent morbidity or mortality.

Conclusion: In this comprehensive series the stereotactic suboccipital-transcerebellar approach using a standard stereotactic system proved to be a favorable stereotactic approach with a high diagnostic success rate and no surgery-related permanent morbidity.

1. Introduction

Frame-based stereotactic surgery of tumors located in deep or eloquent regions in order to obtain a histopathological diagnosis, for drainage of cystic lesions, catheter placement or brachytherapy is a well-established and minimally invasive diagnostic and therapeutic treatment option generally associated with a comparably low complication rate. Lesions of the brainstem and cerebellum, however, are still considered challenging even for a frame-based stereotactic approach. Despite the surgical challenge the distinct histopathological diagnosis of tumors of the posterior fossa is particularly essential for further therapy as molecular tumor characteristics determine new treatment options [1,2]. The suboccipital approach to lesions of the brainstem or the cerebellum was described first in 1978 [3]. Although the technique was further established in the years to come and performed with acceptable rates of morbidity and mortality in children and adults [1,2], the use of standard frame systems revealed to be technically demanding requiring various system modifications [4–6]. The technical challenge of the suboccipital approach results in various alternative stereotactic routes particularly to the brainstem. The transfrontal trajectory is the most common frame-based approach [7–9], but alternative approaches were also described [10,12]. There are few studies comparing the transfrontal and the suboccipital-transcerebellar route depicting either approach comparable concerning the obtainment of a histopathological

☆ Portions of this work were presented in poster form at the 66th Annual Conference of the German Society of Neurosurgery, Karlsruhe, Germany, June 2015.

* Corresponding author at: Department of Stereotactic and Functional Neurosurgery, Medical Center - University of Freiburg, BreisacherStraße 64, D-79106 Freiburg, Germany.
E-mail address: peter.reinacher@uniklinik-freiburg.de (P.C. Reinacher).

https://doi.org/10.1016/j.clineuro.2018.01.015
Received 9 November 2017; Received in revised form 9 January 2018; Accepted 14 January 2018
Available online 19 January 2018
0303-8467/

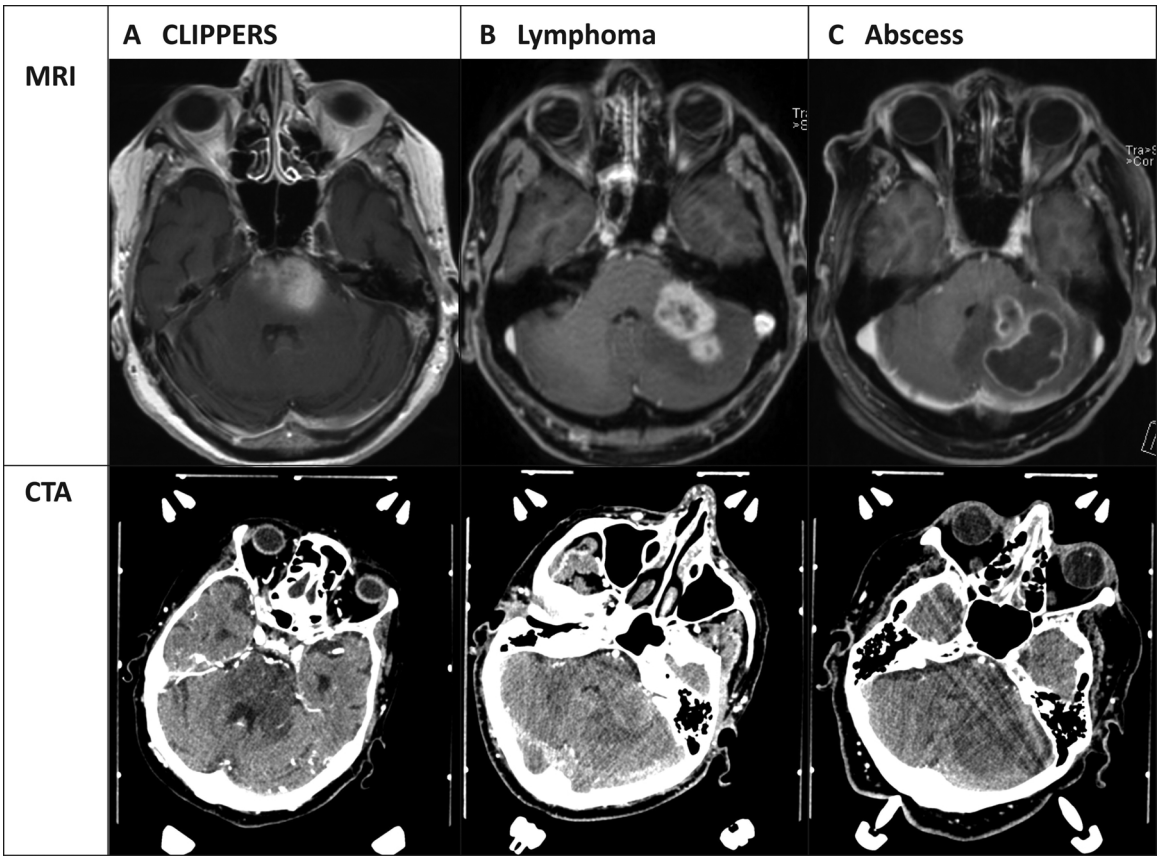

Fig. 1. The suboccipital-transcerebellar approach to lesions of the pons, the middle cerebellar peduncle and the cerebellum.
Representative lesions of the pons (A), middle cerebellar peduncle or cerebellum (B, C) visualized by a preoperative 3D MRI with contrast-enhancement and intraoperative CT angiogram. Note the inclination and rotation of the head within the Leksell Stereotactic Frame to the side of the lesion for about 35°–45° for surgery in prone position. Abbreviation: CLIPPERS Chronic lymphocytic inflammation with pontine perivascular enhancement responsive to steroids.

diagnosis and the complication rate [13,14]. Considering the anatomical localization and underlying pathology (e.g. infection) the shorter suboccipital approach often is advisable if allowed by the frame. In the present comprehensive series we intended to prove this approach to lesions of the pons, middle cerebellar peduncle and cerebellum (Fig. 1) to be safe regarding diagnostic success rate and surgery-related morbidity using two standard stereotactic frames systems without system modifications.

2. Material and methods

During the years 2000–2015 80 patients (age 4–81 years, mean age 43.95 ± 23.76 years; for patient data see Table 1) underwent stereotactic surgery via a suboccipital-transcerebellar approach either for diagnostic reasons i.e. biopsy of lesions of the brainstem or cerebellum, or for therapeutic procedures i.e. volume reduction and drainage of cystic lesions or an isolated 4th ventricle, or brachytherapy. Stereotactic surgery was indicated as method of choice by an interdisciplinary board. Retrospective data analysis was performed. The study design was approved by the Ethics Committee of the Medical Center - University of Freiburg, Germany (EK 587/14). The trial was registered with the German clinical trial registry (DRKS, unique identifier: DRKS00011250). All persons or their relatives gave their informed consent by written treatment contract on admission.

In biopsy cases intraoperative neuropathological analysis of the biopsy tissue confirmed the pathological finding immediately and was followed by detailed histopathological and molecular neuropathological examination. For all procedures analysis of intraoperative stereotactic technique, achievement of the predefined surgical objective and perioperative complications was carried out. In biopsy cases the surgical objective was defined as obtainment of a reliable neuropathological diagnosis; In this series, the majority of procedures referred to stereotactic biopsies in order to obtain a neuropathological diagnosis or pathogen of inflammation. As tumor debulking was no primary target of these procedures, there was no need for postoperative evaluation of changes in tumor size. In cases where volume reduction and drainage of cystic lesions or an isolated 4th ventricle was the goal of surgery, postoperative CT scans were reviewed by non-blinded neurosurgeons and neuroradiologists. Significant volume reduction of the cystic lesion or the formerly isolated 4th ventricle was regarded as achievement of the predefined surgical objective.

2.1. Stereotactic system setup and surgical technique

2.1.1. Riechert-Mundinger Stereotactic Frame

In our series, two different standard frame systems were used for the suboccipital-transcerebellar approach. In a total of 59 patients (age 3–77 years, mean age 43.25 ± 24.2 years, 11 children < 18 years; for further details see Table 1) stereotactic surgery was performed using the Riechert-Mundinger Stereotactic Frame (MHT Stereotactic Systems Ltd., Germany). There was no need for any frame modification. The standard frame system was preferably placed inversely (88.14%) and fixated the patient's head in a neutral position (Fig. 2). Before frame-fixation local anesthesia was applied to the site of the pins. In 39 patients (66.1%) surgery was performed under local anesthesia and cardiovascular monitoring alone, whereas 20 patients (33.9%) underwent general anesthesia. A computer tomography scan (CT) of the frame-fixed head was routinely taken for intraoperative surgical planning. Planning of the stereotactic approach was performed using image fusion of intraoperative high-resolution CT scans with contrast-