Clinical Neurology and Neurosurgery 113 (2011) 758–761

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

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

MR-based follow-up of the superior cerebellar artery after radiosurgery for trigeminal neuralgia

José Lorenzoni [a,*], Philippe David [b], Marc Levivier [c]

[a] Department of Neurosurgery, School of Medicine, Pontificia Universidad Católica de Chile, Chile
[b] Department of Radiology, Hôpital Erasme, Université libre de Bruxelles, Brussels, Belgium
[c] Department of Neurosurgery, Centre Hopitalier Universitaire Vaudois, Université de Lausanne, Switzerland

ARTICLE INFO

Article history:
Received 17 February 2009
Received in revised form 4 July 2011
Accepted 5 August 2011
Available online 8 September 2011

Keywords:
Radiosurgery
Trigeminal neuralgia
Superior cerebellar artery
Stenosis
Vascular damage

ABSTRACT

Purpose: To study with a non invasive method any potential radiological change on the superior cerebellar artery (SCA) in patients treated radiosurgically for classic trigeminal neuralgia (CTN).
Materials and methods: A retrospective measure of maximal dose received by SCA was performed analyzing the treatment planning in 55 consecutive patients treated by Gamma Knife radiosurgery for an CTN, then, a prospective study was designed using high resolution MR, with T2 SPIR, T1 without and with gadolinium enhancement, Proton density, 3D TONE and MIP reconstructions. Inclusion criteria were: patients followed at our institution, follow-up of one year or more, dose received by the SCA of 15 Gy or more and voluntary patient participation in the study. Patients with repeated Gamma Knife radiosurgery for failure or recurrence were excluded. The end points were: SCA occlusion, stenosis or infarction in the territory supplied by SCA.
Results: Sixteen patients were studied, with a mean follow-up of 25.2 months (12–42 months). The mean maximal dose received by the SCA was 57.5 Gy. (15–87 Gy). Among these 16 patients studied, neither obstruction of the SCA nor infarction was demonstrated. In one patient a suspicion of asymptomatic SCA stenosis was visualized distant to the irradiation field.
Conclusions: SCA can receive a high dose of irradiation during radiosurgical treatment for CTN. This study does not confirm any vascular damage to the SCA after radiosurgery for CTN.
© 2011 Elsevier B.V. All rights reserved.

1. Introduction

Stereotactic radiosurgery is nowadays a valid and useful treatment for classic trigeminal neuralgia (CTN) [1–4] with outcomes in terms of pain control comparable to others ablative percutaneus treatments such as thermocoagulation and balloon micro-compression [5].

The exact etiophatogeny of CTN is not absolutely well understood. A vascular compression to the nerve has been proposed as a factor playing an important role in the etiology and the possible cause of the disease [6,7].

High resolution magnetic resonance (MR) imaging has been used successfully for the anatomical study of the trigeminal nerve (TN) and his vascular relationships in patients with CTN [8–10].

In most cases, the vessel involved in the vascular compression is the superior cerebellar artery (SCA) [6–10].

Some authors have communicated vascular damage and stroke [11–16] after radiosurgery for different pathologies. Macroscopic vessel atherosclerosis-like changes have been visualized during a micro-vascular decompression after radiosurgery for CTN [17,18].

Because of the close anatomical relationship between the TN and the SCA, this vessel can receive a high dose of irradiation after a radiosurgery.

The aim of this study was to evaluate prospectively the permeability of the SCA after radiosurgery for CTN using a non-invasive method, such as MR and angiography by magnetic resonance (angio-MR). Any evidence of cerebellar infarction in the territory supplied by the SCA was studied as well.

2. Materials and methods

A retrospective revision was done for the treatment planning of 55 patients with CTN treated with Gamma Knife radiosurgery at the “Centre Gamma Knife” of the Université Libre de Bruxelles, Brussels, Belgium between August 2000 and October 2002.

* Corresponding author at: Departamento de Neurocirugía, Hospital Clínico, Pontificia Universidad de Chile, Marcoleta 352, 2° piso, Santiago, Chile.
Tel.: +56 2 3543465.
E-mail addresses: jls@med.puc.cl, jglorenzoni@hotmail.com (J. Lorenzoni).

0303-8467/$ – see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.clineuro.2011.08.013

Table 1
General characteristics of the 16 patients studied.

Patient number	Age (years)	Gender	Treated side	Maximal dose to the trigeminal nerve (Gy)	Maximal dose to the SCA (Gy)	Follow-up (Months)
1	59	F	Right	90	15.5	42
2	65	M	Right	90	87	36
3	57	F	Right	90	41.1	42
4	65	M	Left	90	69	34
5	53	F	Left	90	37.2	32
6	52	M	Right	90	39.5	27
7	72	M	Left	90	57	26
8	71	M	Left	90	59.7	26
9	70	M	Right	90	83.7	24
10	63	M	Left	90	84	26
11	56	F	Right	90	52.3	21
12	86	M	Right	90	25.5	14
13	62	M	Right	90	66.2	12
14	64	F	Right	90	76.3	12
15	71	M	Right	90	45.8	12
16	64	F	Left	90	79.6	17

In all patients, radiosurgery was indicated when pain control was not possible using full medical therapy or after failure of some previous surgical procedure.

A maximal dose of 90 Gray (Gy) was delivered with a Leksell Gamma Knife C (Elekta Instruments AB, Stockholm, Sweden) at the distal cisternal part of the TN, using a 4 mm collimator and trying to give a dose to the brain stem of no more than 12 Gy as described previously [2,19].

For radiosurgical treatment, the MR study was made using a 1.5 Tesla MR system, with 1 mm axial slices parallel to orbito-metal plane, in sequences T1 (with and without gadolinium enhancement) and T2 SPIR with sagital and coronal reconstructions.

Revision of planning images was made in a dynamic manner (moving in the screen in real time between the different adjacent slices), using multiplanar (axial, coronal and sagital planes) and using different sequences in the software Gamaplan version 5.34 (Elekta Instruments AB, Stockholm, Sweden).

T2 SPIR was initially used for a general anatomic approach, identifying the brain stem, the sensory root of the trigeminal nerve, and all the vascular structures close to the nerve, then, T1 without and with gadolinium enhancement were used for confirmation of vessels.

Arteries and veins were differentiated analyzing their anatomical patterns, following each structure dynamically in the consecutive slices in axial, coronal and sagital views.

The SCA was identified and followed in the consecutive slices as described. The curves of isodose were displayed and the maximal radiation dose received by the SCA was measured.

A prospective evaluation of the permeability of SCA was done by MR, using 1 mm thick slices of the sequences: T2 SPIR, T1 without and with gadolinium enhancement, Proton density and 3D TONE. Angio-MR mip images were obtained as well.

Inclusion criteria were: patients followed at our institution with a follow-up of one year or more, dose received by the SCA more than 15 Gy and voluntary patient participation in the study. Patients with repeated Gamma Knife radiosurgery for failure or recurrence were excluded. The end points of the study were: SCA occlusion, SCA stenosis or infarction in the territory supplied by SCA.

3. Results

Among the 55 patients treated during the period between August 2000 and October 2002, 16 patients met the inclusion criteria and were studied prospectively with the described protocol.

Table 1 summarizes the general characteristics of these 16 patients studied.

There were 10 men and 6 women, with a mean age of 64 years (range from 52 to 86). The mean maximal dose received by the SCA was 57.5 Gy (range from 15 to 87), and the mean follow-up after treatment was 25.2 months (range from 12 to 42).

There was no patient with any evidence of infarction in the territory supplied by the SCA and no vessel occlusion was visualized.

In one patient, an asymptomatic superior cerebellar artery stenosis was suspected. This patient was a 71 years old male treated for a left CTN. The maximal dose received by the SCA was 59.7 Gy and the radiological study was done 26 months after radiosurgery. This stenosis suspicion was located out of the irradiation isocentric field centred in the distal cisternal portion of the trigeminal nerve (Fig. 1).

4. Discussion

Ionizing radiations can induce changes in the vasculature, being the small vessels the most vulnerable to the effect of radiations [20].

Histophatologic studies in animal models [21,22] and in human specimens of arterio-venous malformations (AVM) [23–26] have shown that in irradiated vessels there is an initial endothelial damage followed over time by proliferation of fibroblasts and collagen production in the subendotelial region and also in the middle muscular layer. These changes carry a progressive wall thickening of the vessel with subsequent narrowing of the lumen. In addition, intraluminal thrombus and microtrombus probably facilitated by an abnormal endothelium also could play a role in the vascular obstruction [22,24,25].

Kamyryo [22] described occlusion of the anterior cerebral artery with brain infarction in a rat 20 months after irradiation of the artery with a dose of 100 Gy. The histopathological study of the artery showed thickening of the wall, fibrosis, collagen deposition and fibrinous trombosis.

Yamamoto [15], communicates stenosis of the main trunck of the middle cerebral artery 3 years after Gamma Knife treatment of an AVM. In this case the estimated dose received by the artery was between 5.1 and 9.8 Gy.

Lim [12] reports a cerebral capsular lacunar infarction 4 years after a Gamma Knife treatment of a pituitary adenoma in a 35 years old male. A carotid artery occlusion was documented by Doppler ultrasound. The dose of irradiation received by the carotid artery was under 20 Gy. In this case both carotid arteries were enveloped by the tumor.

Download English Version:

https://daneshyari.com/en/article/3040990

Download Persian Version:

https://daneshyari.com/article/3040990

Daneshyari.com