Koos Classification of Acoustic Schwannomas: A Reliability Study

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Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of the Koos grading scale with regard to reliability and potential validity when characterizing acoustic schwannomas. 2) Discuss, in small groups how a reliable and valid grading system can assist in counseling patients on their diagnosis and in discussing treatment options. 3) Identify the importance of reliability assessments on widely used grading scales

Introduction

The Koos classification of acoustic neuromas (Fig. 1), introduced in 1998, is a system designed to stratify these tumors based on extrameatal extension and compression of the brainstem. Grade I tumors are completely confined to the internal auditory canal. Grade II tumors have both intra- and extra-meatal components, but do not contact the brainstem. Grade III tumors make contact with the brainstem but do not compress it, while grade IV tumors cause brainstem compression (1). While this classification system is widely reported in the literature, to date no study has assessed the reliability of this grading system. We present an assessment of the intra- and inter-rater reliability of the Koos classification system.

Methods

A retrospective chart review was performed and the MRIs of 40 patients with acoustic schwannomas were selected for review (Fig 2). Four raters were selected to assign a Koos grade to 50 total scans (10 scans were randomly selected for test-retest). Inter- and intra-rater reliability was calculated and reported using Fleiss' kappa, Kendall's W, and Intraclass correlation (ICC).

Table 1

Table 1. Koos Grading Scale - Interrater Reliability Estimates, N=40

Parameter	Kappa (κ)	SE	p value	Kendall's W coefficient	p value	Intraclass coefficient (ICC)	p value
Tumor grade	.71	.04	<.001*	.92	<.001*	.88	<.001*

κ = Fleiss' generalized Kappa for multiple raters; Kendall's coefficient of concordance (W) for ordinal data; intraclass correlation (ICC) for ordered, Likert-type, or continuous data. SE - standard error;

*p value <.05 considered statistically significant

Inter-Rater Reliability

References

1. Koos WT, Day JD, Matula C, Levy DI. Neurotopographic considerations in the microsurgical treatment of small acoustic neurinomas. J Neurosurg. 1998;88(3):506-512.

Figure 1

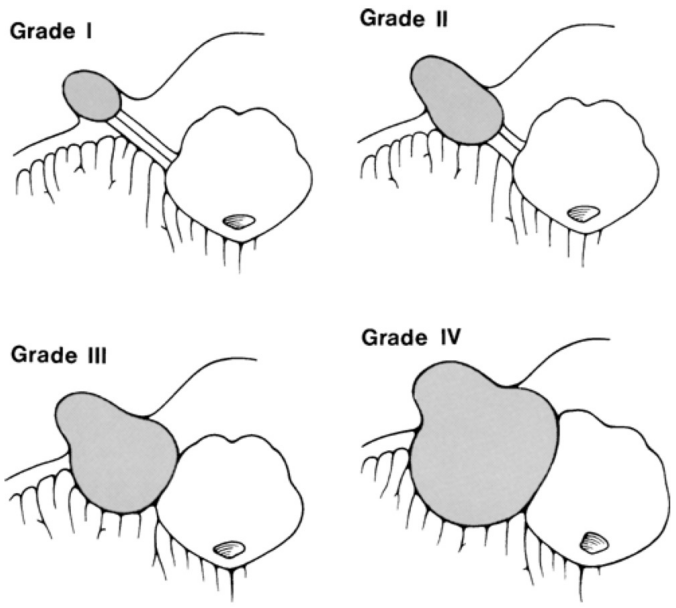


FIG. 1. Diagrams depicting tumor grading system developed by the senior author. Grade I = small intracanalicular tumor. Grade II = small tumor with protrusion into the CPA; no contact with the brainstem. Grade III = tumor occupying the cerebellopontine cistern with no brainstem displacement. Grade IV = large tumor with brainstem and cranial nerve displacement.

Original Koos Classification System (1) - Provided to all raters for instruction.

Table 2

Table 2. Koos Grading Scale - Intra-rater Reliability Estimates of Tumor Grade, N=40

	Kappa (κ)	ASE	p value	Kendall's W coefficient	p value	Intraclass coefficient (ICC)	p value
Rater 1	1.00	0	<.001	1	<.001*	1	–
Rater 2	1.00	0	<.001	1	<.001*	1	–
Rater 3	.92	.07	<.001	.99	<.001*	.96	<.001*
Rater 4	1.00	0	<.001	1	<.001*	1	–

Weighted kappa (quadratic weights); Kendall's coefficient of concordance (W) for ordinal data; intraclass correlation (ICC) for ordered, Likert-type, or continuous data. ASE - asymptotic standard error;

*p value <0.05 considered statistically significant

Intra-rater Reliability

Results

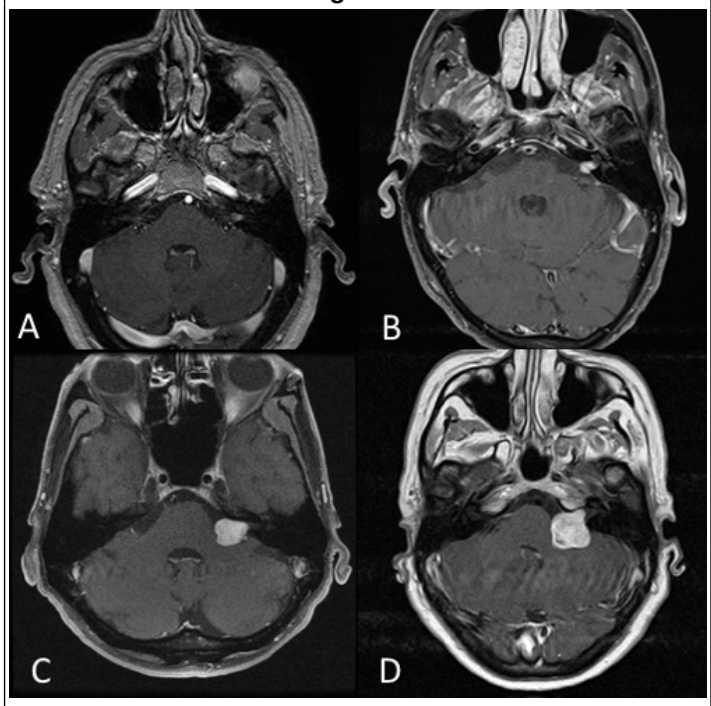
Inter-rater reliability was found to be substantial when measured using Fleiss' kappa (0.71), extremely strong using Kendall's W (0.92), and excellent as calculated by ICC (0.88). *See Table 1

Intra-rater reliability was perfect for three out of four raters as assessed using weighted kappa, Kendall's W and ICC, with the intra-rater agreement for the fourth rater measured as extremely high. *See Table 2

Conclusions

We have demonstrated that the Koos classification system for acoustic schwannoma is a reliable method for tumor classification. This study lends further support to the results of current literature using the Koos grading system. Further studies are required to evaluate its validity and utility in counseling patients with regard to outcomes.

Figure 2



MRI Examples. A: Koos Grade I B: Koos Grade II C: Koos Grade III D: Koos Grade IV