Is C1 lateral mass screw placement safe for the Chinese, Indians, and Malays? An analysis of 180 computed tomography scans

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Abstract

Introduction: C1 lateral mass (CILM) screw is a common procedure in spine surgery. However, related studies are lacking in Asia. We aim to determine the safety of CILM screw for the Chinese, Indians, and Malays. Methods: Three-dimensional computed tomographies of 180 subjects (60 from each ethnic) were analyzed. The length and angulations of CILM screw and the location of internal carotid artery (ICA) in relation to CILM were assessed and classified according to the classification by Murakami et al. The incidence of ponticulus posticus (PP) was determined and the differences among the population of these three ethnicities were recorded. Results: The average base length was 85 ± 14 mm. The lengths within the lateral mass were between 14.7 ± 1.6 mm and 21.7 ± 2.3 mm. The prevalence of PP was 8.3%, 55.3% (19) of ICA were located in zone 0; 38.3% (13) in zone 1; 6.4% (2) in zone 1-2; and none in zone 1-3 and zone 2. The average angulation from the entry point to the ICA was 85° ± 64° laterally. The mean distance of ICA from C1 anterior cortex was 3.7 ± 1.7 mm (range: 0.5–11.3). There was no difference in distribution of ICA in zone 1 among the three populations (Chinese: 47%, Indians: 61%, and Malays: 53%; p > 0.05). Conclusions: No ICA is located medial to the entry point of CILM screw. If bicortical purchase of CILM screw is needed, screw protrusion of less than 3 mm or medially angulated is safe for ICA. The incidence of PP is 8.3% with higher prevalence among the Indian population.

Keywords

C1 morphometry, C1 lateral mass screw safety, Chinese, Indian, internal carotid artery, Malay, ponticulus posticus

Introduction

C1 lateral mass (CILM) and C2 pedicle screw systems are the methods of fixation for posterior C1/C2 instrumentation. It is gaining more popularity because of the superior biomechanical advantage.1,2 CILM screw is challenging due to the close proximity of internal carotid artery (ICA) and vertebral artery (VA). Violation of VA by C1 screw is uncommon compared to C2 screws. However, approximately 5% of C1LM screw violation into the VA foramens were reported by Youm et al.3 Carrier et al. reported a case of ICA impingement by a well-positioned C1-C2 transarticular screw.4 Bagheri et al. presented a case of ICA pseudoaneurysm causing repeated cerebral infarcts secondary to C1-C2 transarticular screw.5 Previous publications have reported on the vascular anatomy, safety, and feasibility of CILM screws.6–9 However, there are few studies which analyzed the safety of CILM screws in Asians and specifically in Chinese, Indians, and Malays who represent the majority of the population in the Southeast Asia region.10 Hence, this study was designed to determine the feasibility and safety of CILM in these Asians, with reference to the C1 vertebral morphology, presence of ponticulus posticus, and the relation of ICA to the CILM.

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