INTRODUCTION: C1 lateral mass screws have recently become a popular technique for obtaining fixation into the Atlas. Occasionally, the placement of a C1 lateral mass screw can be difficult due to an engorged venous plexus or the large C2 nerve root. As a result, some experts have suggested starting the screw more cranially on top of the posterior arch of C1 in patients who have a broad posterior arch. Recently, during a course on cervical spine fixation techniques, we discovered a specimen with what appeared to be a broad posterior arch of C1. Further dissection, however, revealed that it was in fact a ponticulus posticus (“little posterior bridge”) of an arcuate foramen. An informal survey of the faculty and participants revealed that this anomaly was known to only a few of the many experienced cervical spine surgeons at the course. The ponticulus posticus is a bony bridge that covers the vertebral artery as it lies cranial to the posterior arch of C1. The bridge of bone forms a foramen, called the arcuate foramen. The complex is also called Kimmerle’s anomaly, eponymously after the author who described this bony abnormality in 1930. We believe that it is an important anomaly to recognize for all surgeons who operate in the upper cervical spine, and especially during placement of C1 lateral mass screws. Mistaking this for a broad posterior arch of C1 and putting a screw into it may result in injury to the vertebral artery.

The purpose of this study is to determine the incidence of this anomaly and to illustrate the potential dangers of cervical screw placement into an unrecognized Arcuate Foramen.

METHODS: Radiographic study: we examined 464 lateral cervical spine radiographs to determine the incidence of this anomaly. 336 of these were from digitized images in a radiology department. 128 were from patients who had presented to the office of one of the co-authors, a spine surgeon. Anatomical dissection: We dissected a specimen that was identified as having a ponticulus posticus during a cervical spine course. In addition, we dissected twenty additional cadavers to identify an additional two with an arcuate foramen to determine their anatomical characteristics.

RESULTS: Radiographic analysis: 72 of 464 lateral cervical radiographs, had arcuate foramina. The prevalence of arcuate foramina in our patient population...
was 15.5%. Figure 1 illustrates the typical radiographic appearance of an arcuate foramen on a lateral radiograph. It appears as an intact ring in the posterior superior aspect of the atlas.

Anatomic dissections: The lateral mass of C1 is anterior to and extends both cranial and caudal to the posterior arch. The vertebral artery is located on the cranial side of the arch and the C2 nerve root and ganglia lies under the arch. The ponticulus posticus covers the vertebral artery and becomes contiguous with the posterior arch. Figure 2 shows the original specimen that prompted this study. A screw had been placed into the posterior arch and then removed. The lateral aspect of what was thought to be the posterior arch was then removed to reveal that it was in fact a ponticulus posticus. The screw had made a small perforation in the artery.

CONCLUSIONS: Our radiographic data reveal that this is a relatively common anomaly that occurs in nearly 15% of the population. Although the anomalous ponticulus posticus and arcuate foramen was first described over 70 years ago, to our knowledge, its clinical importance has yet to be addressed in the spine literature. Most studies discuss the anomaly in relation to posterior cranial fossa strokes as well as chiropractic manipulation of the neck. We believe this is the first discussion regarding the importance of the arcuate foramen and the placement of C1 lateral mass screws. Before placing a screw into what might appear to be a widened posterior arch of C1, we recommend reviewing the lateral cervical spine radiograph to determine the presence of an arcuate foramen. What appears as a wide posterior arch might in reality be an arcuate foramen containing the vertebral artery.

Figure 1: Lateral Radiograph of Arcuate Foramen of C1
Figure 2: Cadaver Specimen showing a close-up of the lateral aspect of C1 and C2. The greater occipital nerve has been removed as has the lateral aspect of the Ponticulus posticus (PP). The drill hole is in the posterior arch of C1. The vertebral artery was perforated within the hole.
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