Routine Use of Posterior Arch Screws for C1 Fixation: Feasibility and Related Complications

INTRODUCTION: Starting a C1 screw at the posterior arch has advantages over starting it directly into the lateral mass, including decreased C2 root irritation, and bleeding from the paravertebral venous plexus. However, if the posterior arch is too small, it may not be feasible and might lead to vertebral artery injury, particularly if there is a ponticulus posticus. We evaluated the feasibility of and complications related to the routine posterior C1 arch screws.

METHODS: A retrospective analysis of a consecutive series of patients treated by the first author was performed by clinically uninvolved surgeons. Whenever C1 posterior fixation was necessary, arch screw fixation was attempted as the first choice. Eighty-two arch screws were tried in 42 patients (18 men, 24 women).

After dissecting the C2 root caudally and the vertebral artery cranially away from the C1 arch and protecting them using cottonoids and Penfield retractors, a hole was made using a burr and drill. Screws were inserted under fluoroscopic guidance in the initial 20 patients and with a free-hand technique in the subsequent 22. The screw diameter was 4.0 mm in 32 screws and 3.5 mm in 50. Intraarticular fusion of the C1-C2 facet joint was performed bilaterally in 26 cases, unilaterally in 5, and neither in 11.

A questionnaire consisting of distribution and visual analogue scale (VAS) of paresthetic pain was completed by the patients at every follow-up. The questionnaires, along with prospective database, clinical records, and pre- and post-operative intravenous CT-angiography were analyzed.

RESULTS: The height of 50 posterior arches (61%) was smaller than 4 mm on preoperative CT angiography. Posterior arch screws could be inserted in all cases. Among 9 ponticuli posticus (complete type) in 8 patients, three had to be
removed for safe screw insertion while six were not removed. In seven with
persistent first intersegmental arteries, screws could be inserted while the
arteries were retracted caudally. There were no vertebral artery injuries.
However, the posterior arch was perforated cranially by 5, caudally by 28, and
cranio-caudally by 13 screws. Among the 16 patients with preoperative occipital
neuralgia, nine had complete resolution and seven had alleviation of the pain at
the last follow-up. Among 26 patients without preoperative occipital neuralgia, 7
developed new neuralgia and 4 had persistent pain (VAS 1 to 4) at the last
follow-up at 1 to 7 months.

**CONCLUSIONS:** Routine use of C1 posterior arch screws were feasible even
in those with small posterior arch height, ponticulus posticus, and persistent first
intersegmental arteries. Vertebral artery injury was avoided by dissecting it
before screw insertion. However, cortical perforation was often inevitable.
Occipital neuralgia was not infrequent, though its cause was not clear.