

Thyroid Foramen:

A CT-Based Analysis of Prevalence, Morphology, Size, and Association with the Superior Laryngeal Artery

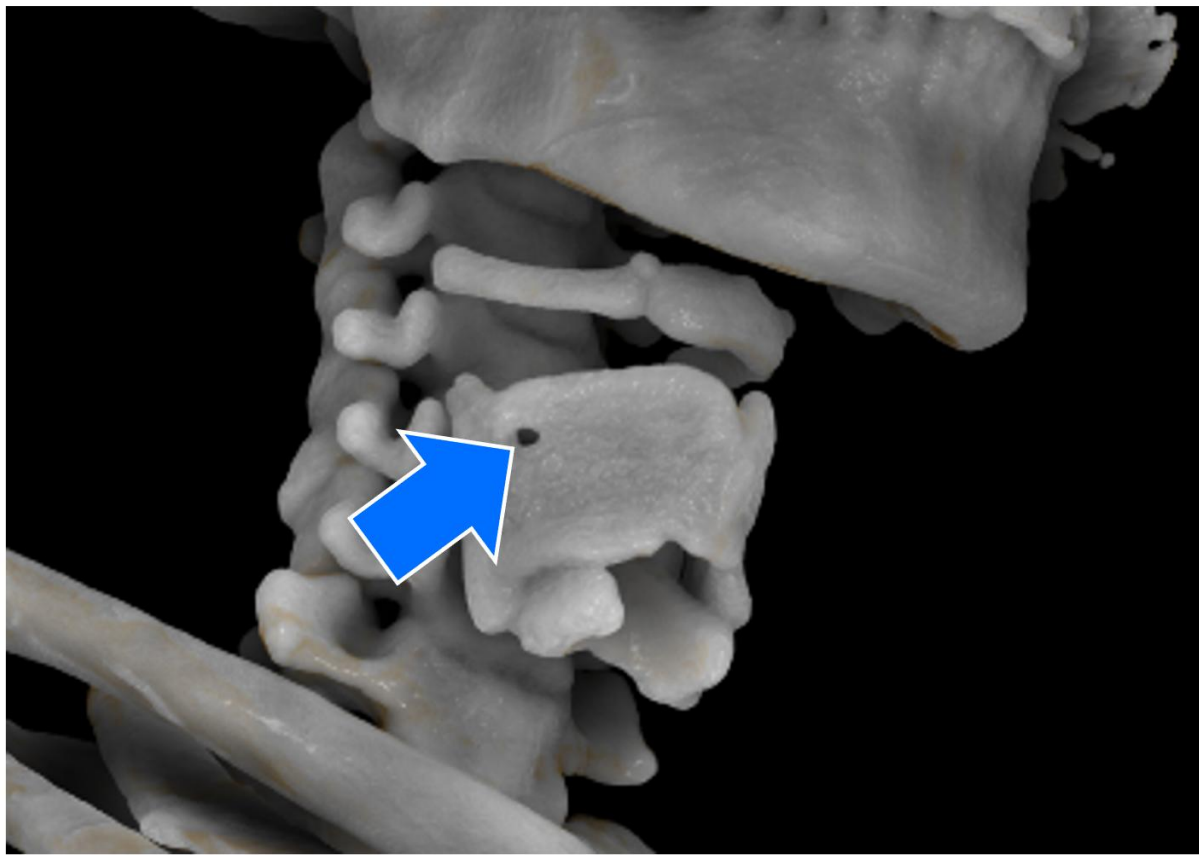
Soma Kumasaka

Yuka Kumasaka, Yasuhiro Fukushima, Daisuke Ozaki

Yusuke Sato, Tomokazu Takeuchi, Yoshito Tsushima

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No COI related to this presentation



Thyroid Foramen

A small congenital opening
in the thyroid cartilage

Our previous study

Thyroid Foramen Can Be Seen on CT

Original Investigation Thyroid Foramen: Prevalence and CT Morphology¹

Soma Kumasaka, MD, PhD, Yasuhiro Fukushima, PhD, Daisuke Ozaki, MS, Yusuke Sato, PhD, Tomokazu Takeuchi, MS, Yuka Kumasaka, MD, PhD, Yoshito Tsushima, MD, PhD

Rationale and Objectives: The thyroid foramen (TF) is a congenital anatomical variant of the thyroid cartilage, characterized by a small opening that may transmit neurovascular structures. Although benign, TF can be misinterpreted on imaging as a cartilage fracture or tumor invasion, and may pose a surgical risk if unrecognized. Despite these potential implications, TF remains under-recognized in routine radiological practice. This study aimed to evaluate the prevalence and morphological characteristics of TF using CT.

Materials and Methods: We retrospectively reviewed 300 noncontrast, thin-slice neck CT scans. TF was defined as a well-demarcated, smoothly margined opening in the posterior thyroid cartilage. Two experienced radiologists evaluated all images in consensus, documenting the presence, shape, laterality, and size of TF.

Results: TF was identified in 77 of 300 patients (25.7%). The prevalence was slightly higher in males (27.8%) than in females (22.6%), but the difference was not statistically significant ($p = .348$). Among TF-positive cases, 24 had bilateral and 53 had unilateral TFs, totaling 101 foramina. Of these, 46.5% were circular, 41.6% oval, and 9.9% crescent-shaped. The mean long and short axis were 3.1 ± 1.1 mm and 2.6 ± 1.0 mm, respectively. TF diameters were significantly larger in males ($p < .001$) and $p = .003$ for long- and short-axis, but showed no correlation with age ($p = .338$ and $.742$, respectively).

Conclusion: TF is a relatively common anatomical variant detectable on thin-slice CT, with a prevalence of 25.7%. Awareness of TF is important to avoid diagnostic pitfalls and prevent potential surgical complications.

Key Words: Thyroid cartilage; Computed tomography; Anatomic variation; Radiographic anatomy.
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Abbreviation: TF thyroid foramen

INTRODUCTION

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between the superior laryngeal and the cricothyroid arteries (3,4).

In radiology, TF has occasionally been misinterpreted as a thyroid cartilage fracture, and may also mimic tumor invasion, especially when it resembles an abnormal bony defect (1,5). Such misinterpretations, particularly on CT or MRI, may lead to diagnostic confusion and inappropriate management. In surgery, unrecognized TF may increase the risk of intraoperative injury to vessels or nerves, especially during thyroidectomy or laryngeal procedures (1,6–8). Despite its clinical relevance, TF remains under-recognized.

Multiple anatomical studies have reported a wide range of prevalence rates (2–57%), primarily due to variations in study population, methodology, and imaging modalities (1,2). Moreover, most existing data are derived from cadaveric dissection or plain radiography, limiting their clinical applicability (1,2,8–11).

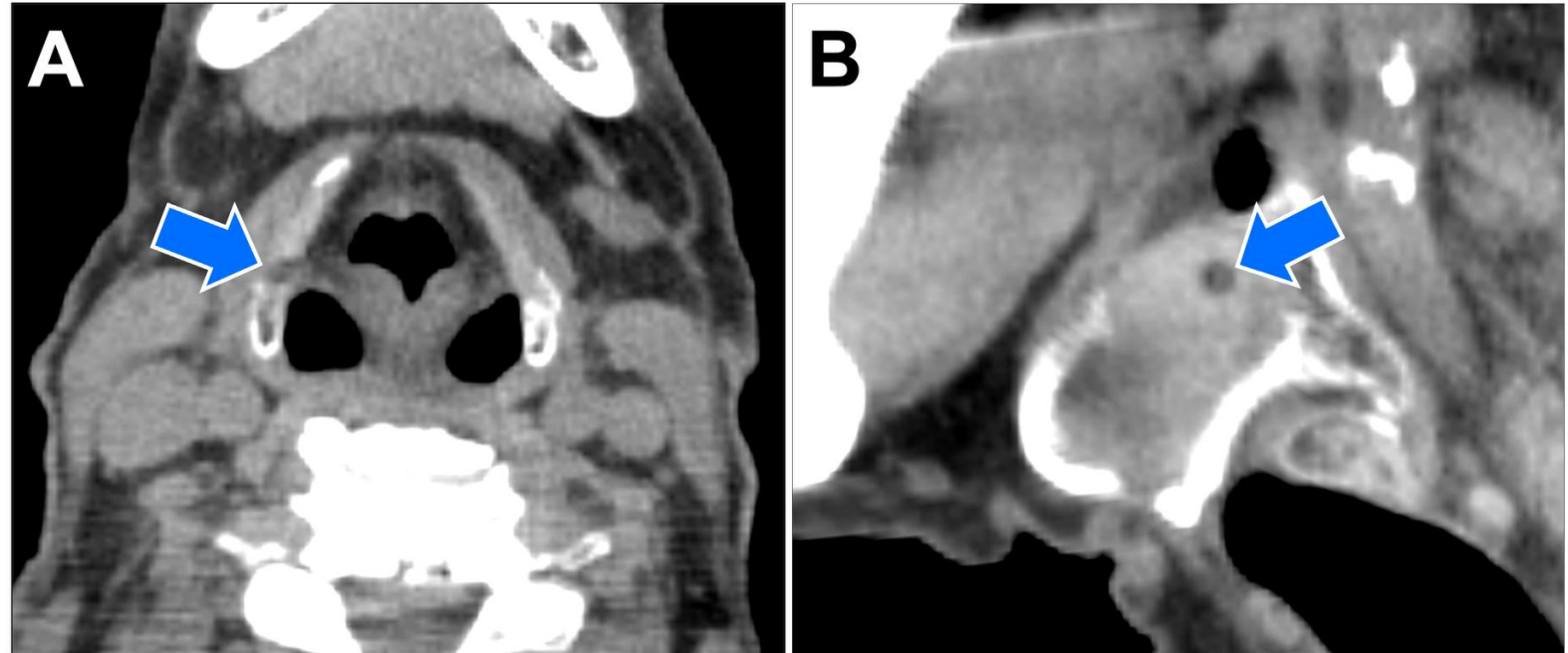
Recent advancements in CT imaging have enabled more accurate in vivo identification of small anatomical variations (12). However, CT-based evaluations of TF prevalence and morphology in living populations remain scarce. Therefore, this study aimed to determine the prevalence and morphological characteristics of TF using thin-slice CT imaging.

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¹Presentation: This work has not been presented, in part or in whole, at any scientific meeting.
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7555

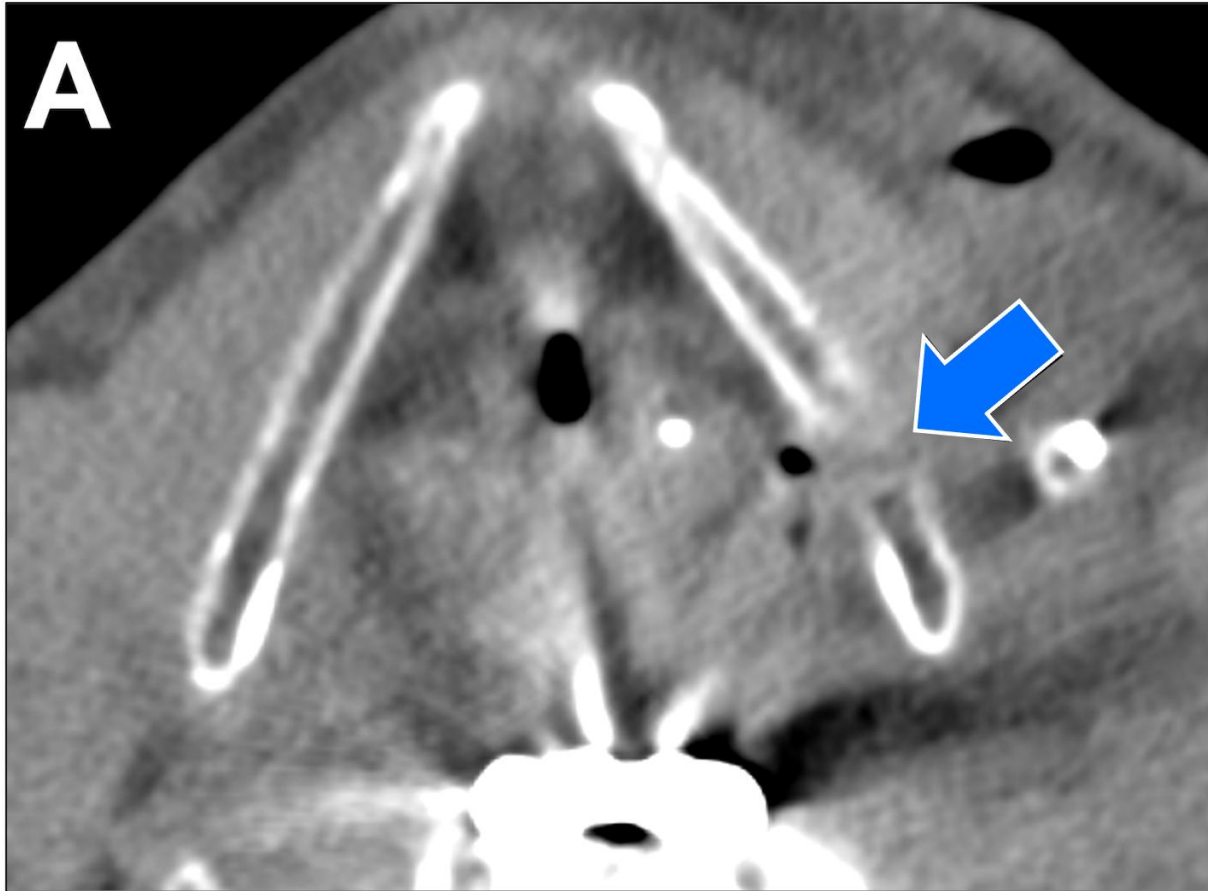


- Detected in 26% of patients
- Unilateral or bilateral
- Size range: 1.1–7.0 mm

Question

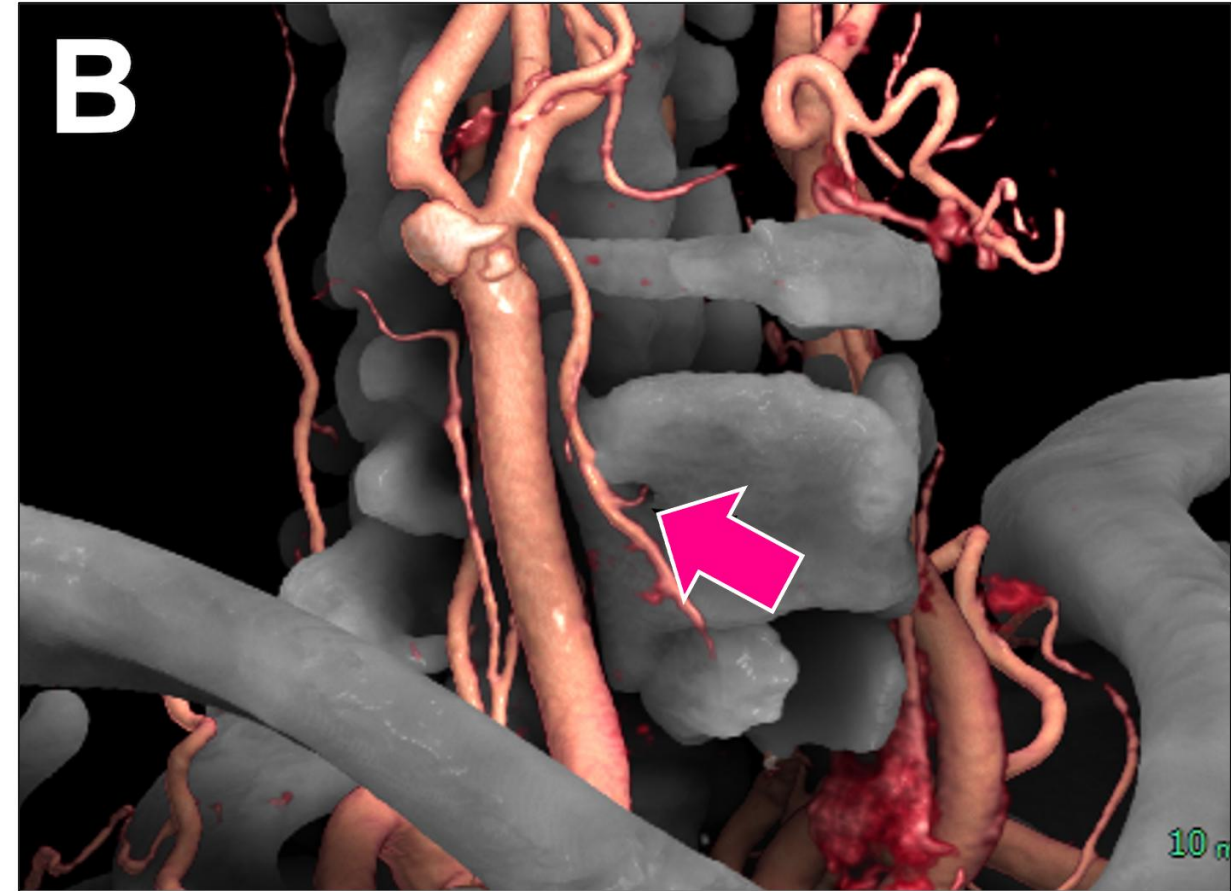
Have you ever mentioned
thyroid foramen
in a CT report?

Thyroid Foramen



CT pitfall

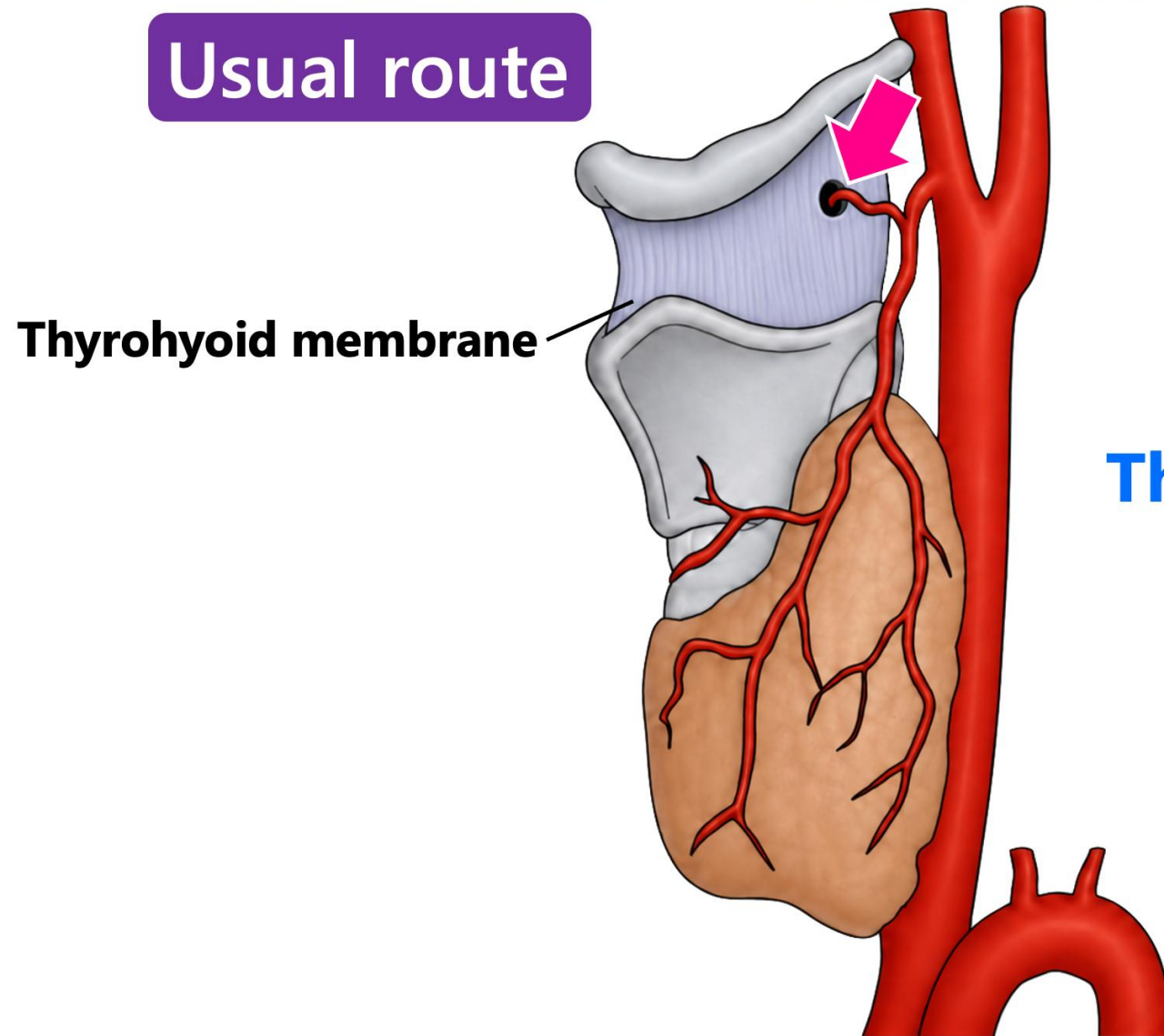
Tumor invasion? Fracture?



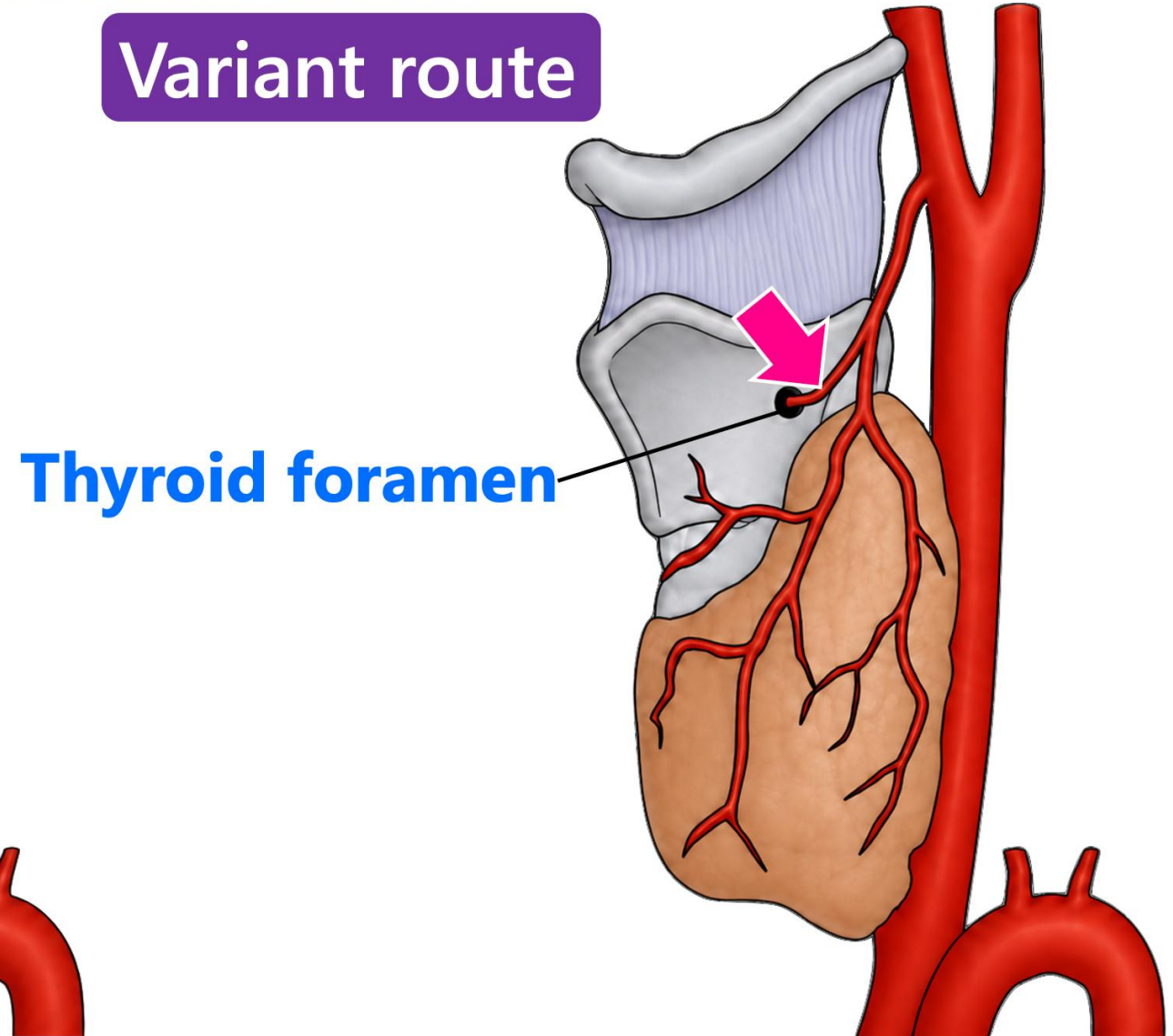
Possible neurovascular pathway

Superior laryngeal artery

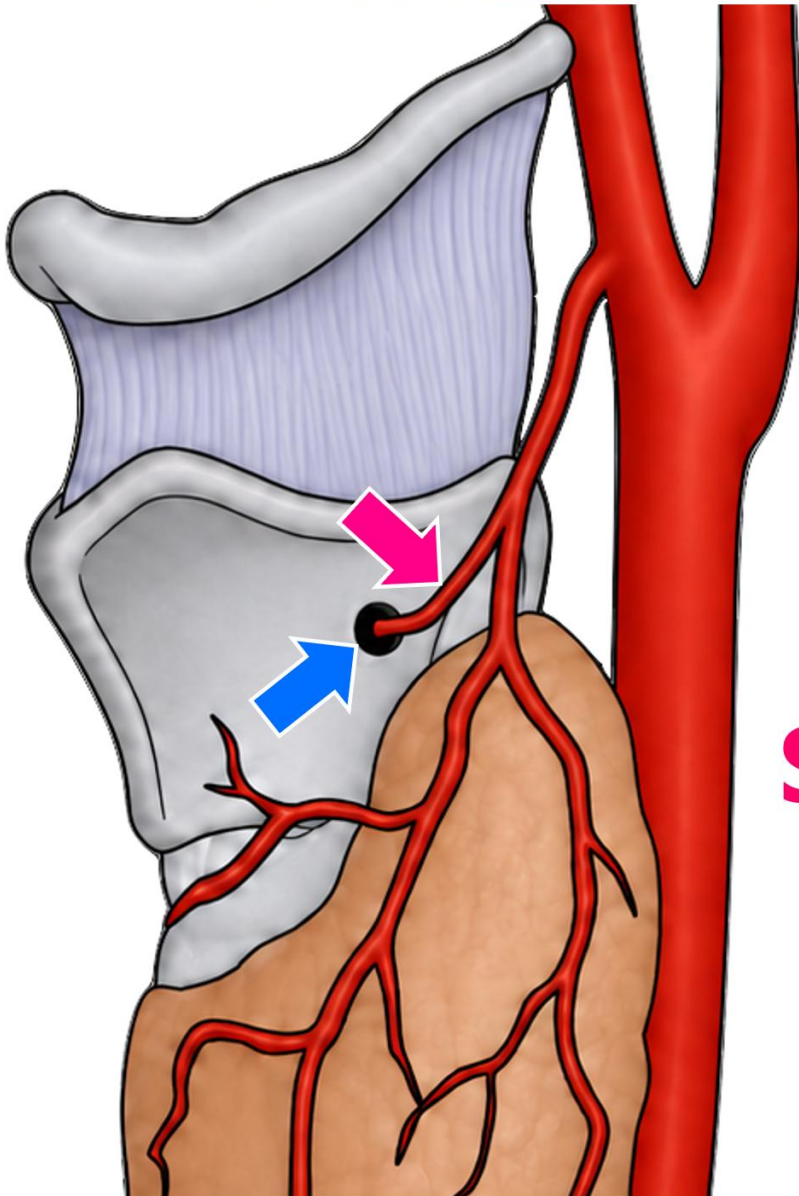
Usual route



Variant route



This relationship remains unclear



Thyroid foramen

×

Superior laryngeal artery course

Purpose

To evaluate the prevalence of
thyroid foramen and its relationship
with **superior laryngeal artery** course
on CT.

Materials

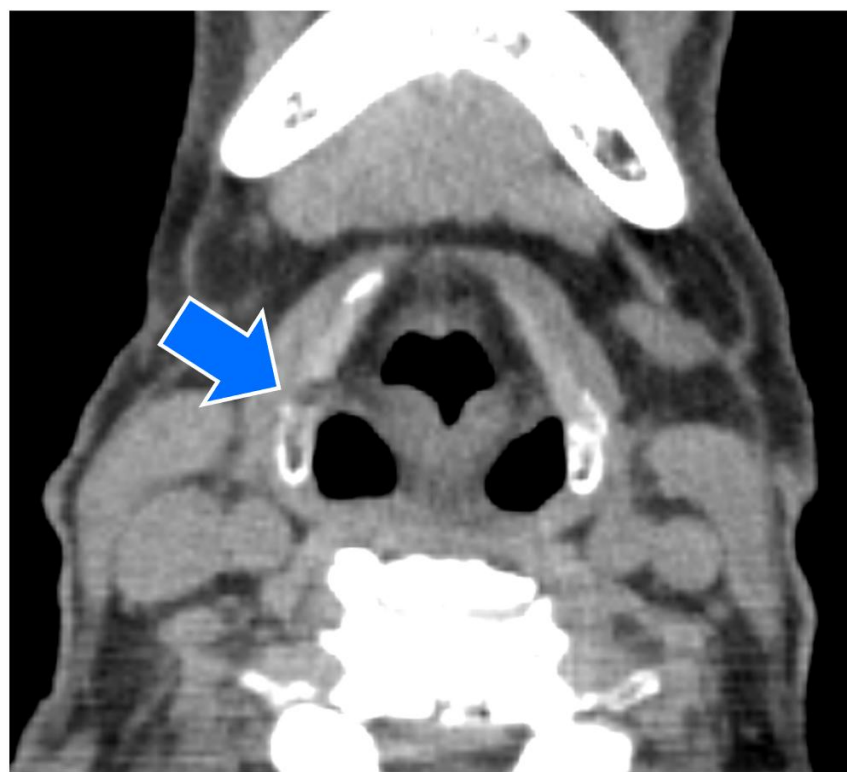
Subjects

414 patients

with non-contrast and arterial-phase CT

Image Evaluation

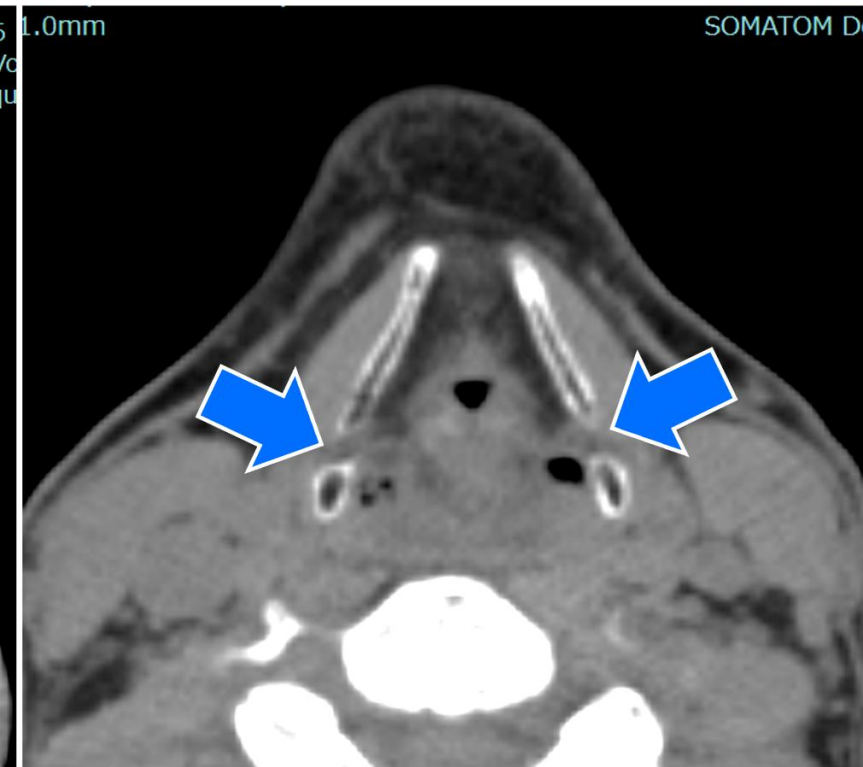
Thyroid foramen: Presence and laterality



**Unilateral
(right)**



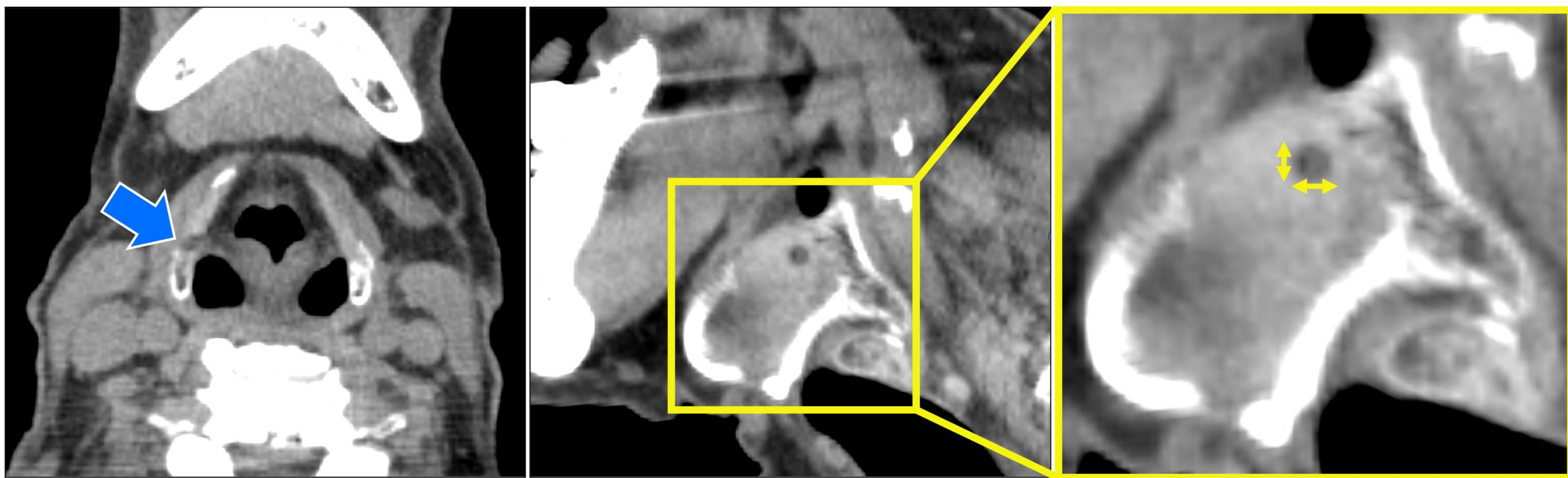
**Unilateral
(left)**



Bilateral

Image Evaluation

Thyroid foramen: Size

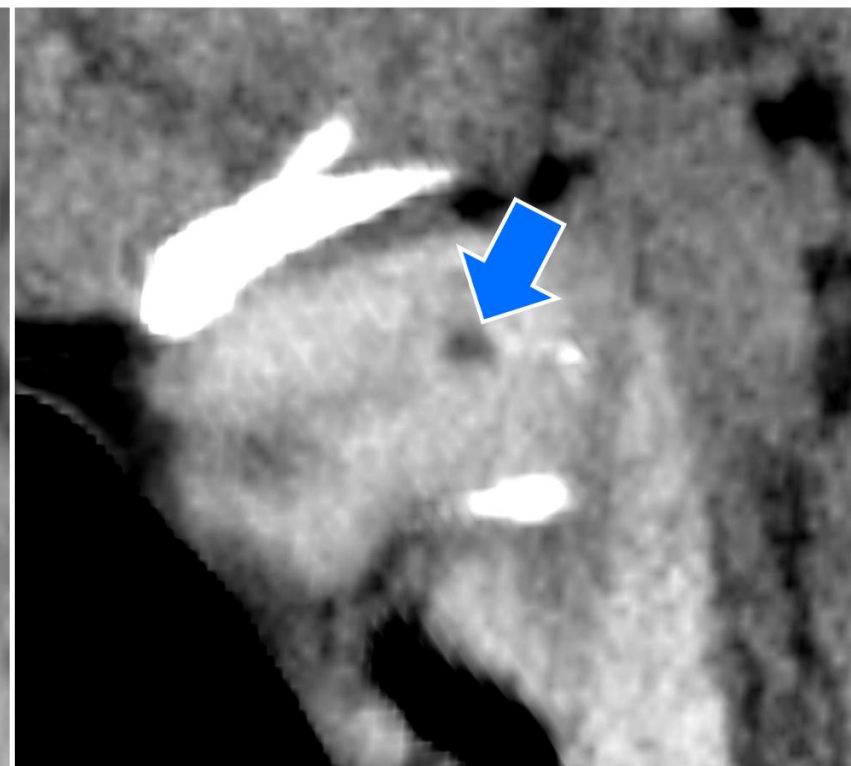
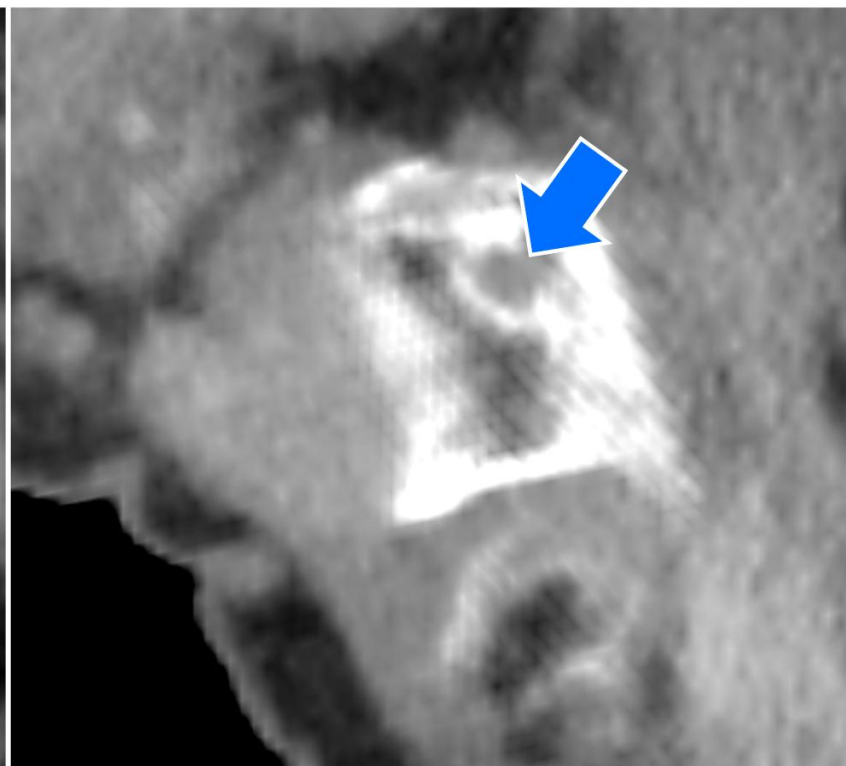
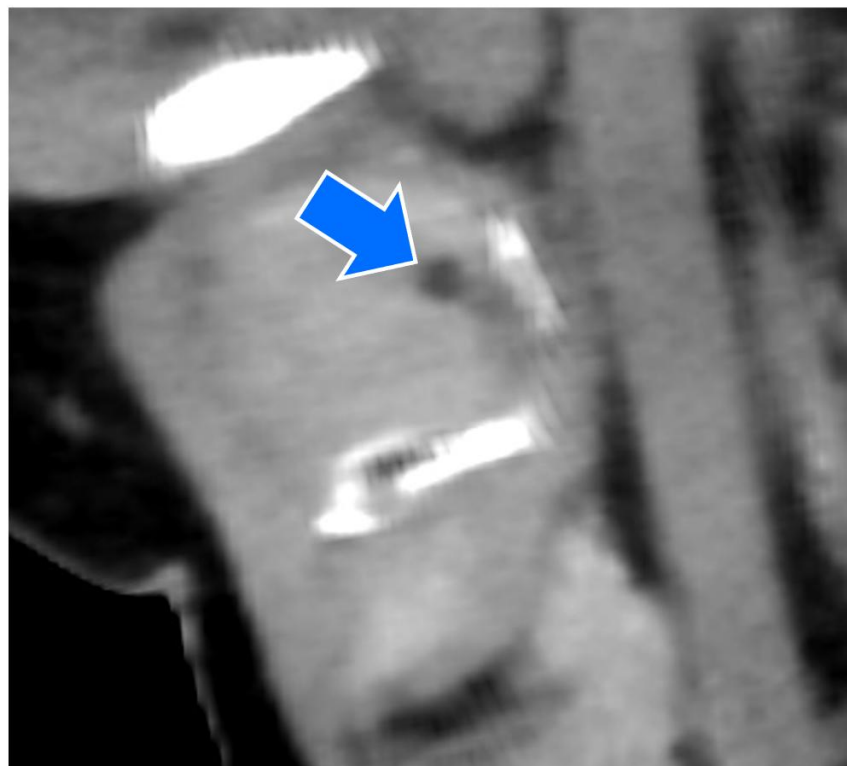


Long axis and short axis

Measured on MPR, mainly oblique sagittal images

Image Evaluation

Thyroid foramen: Morphology



● **Circular**

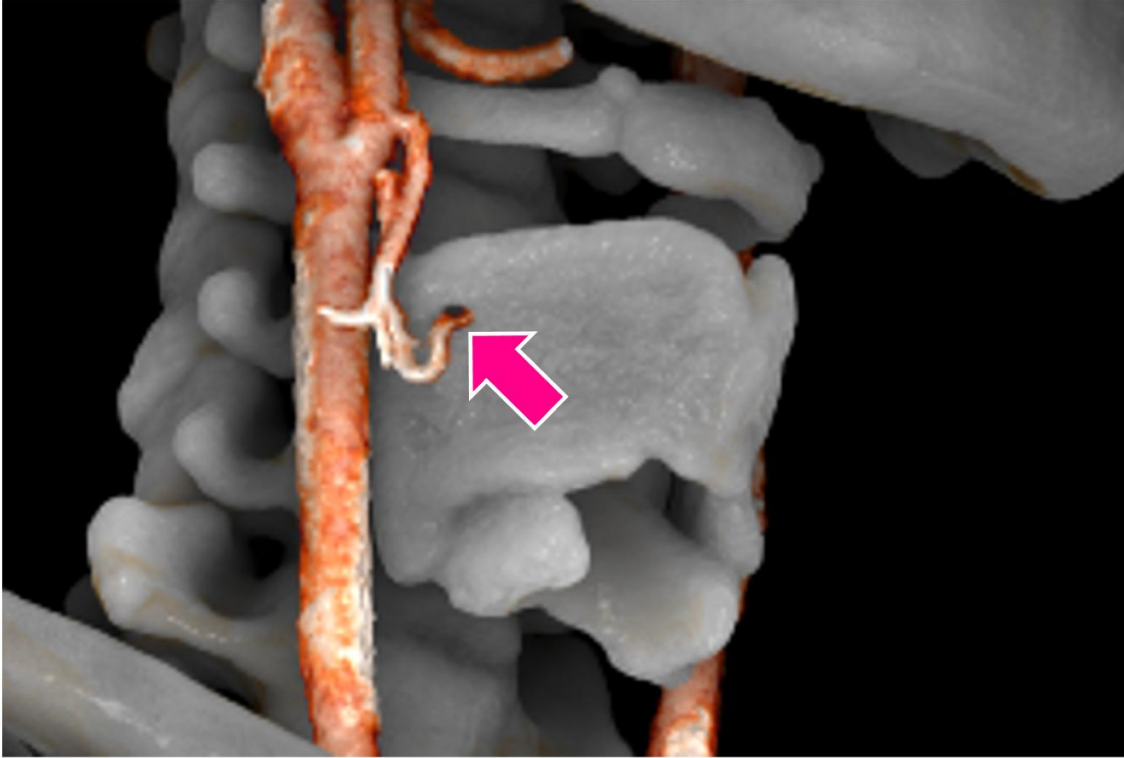
● **Oval**

⤿ **Crescent**

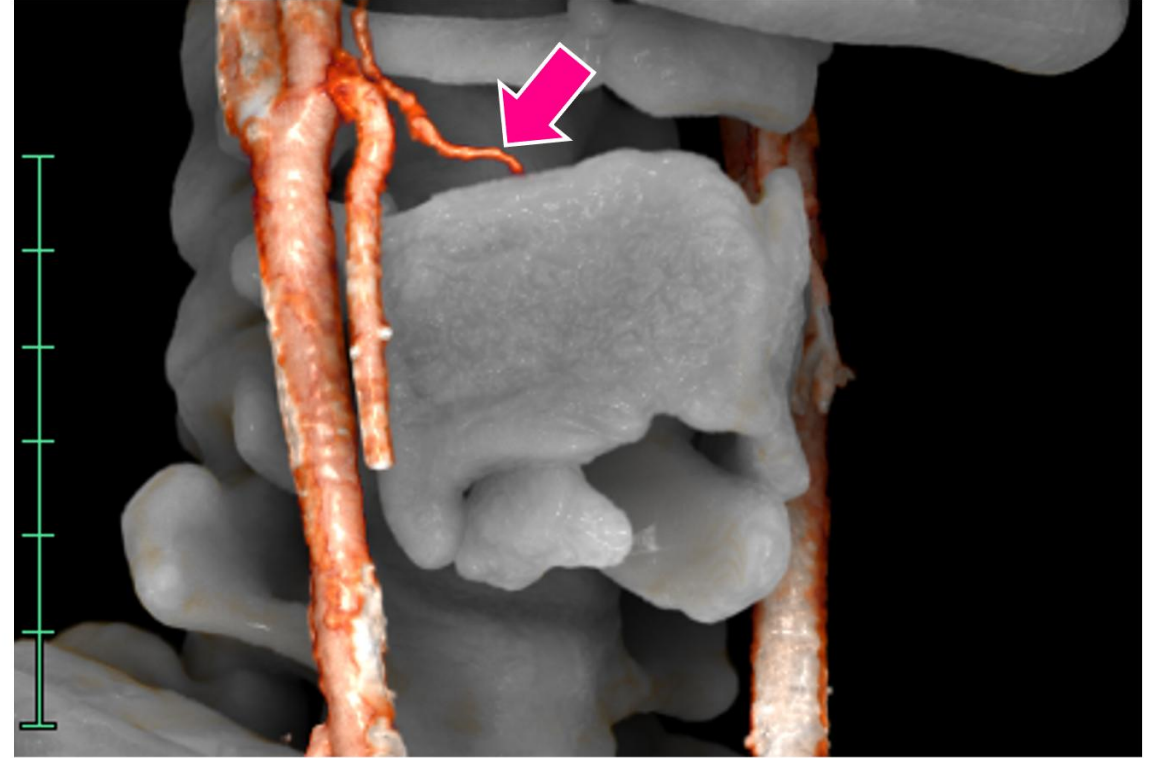
Classified on MPR, mainly oblique sagittal images

Image Evaluation

Superior laryngeal artery course



Through
thyroid foramen

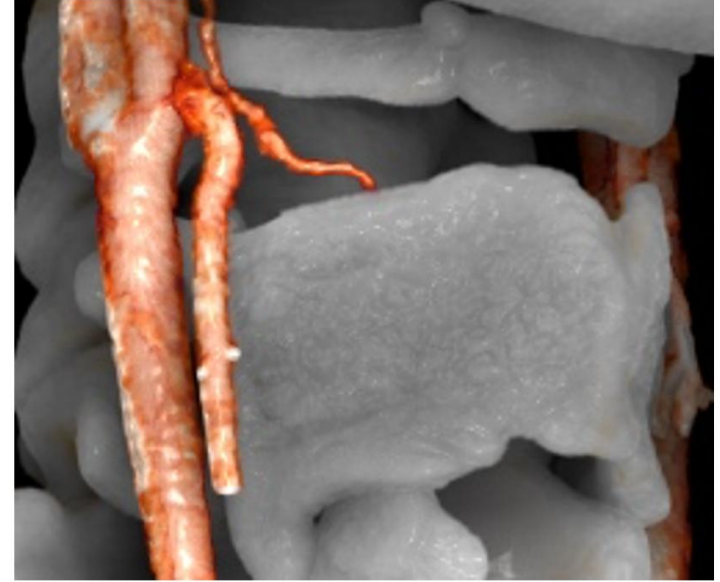


Through
thyrohyoid membrane

Statistical Analysis



VS



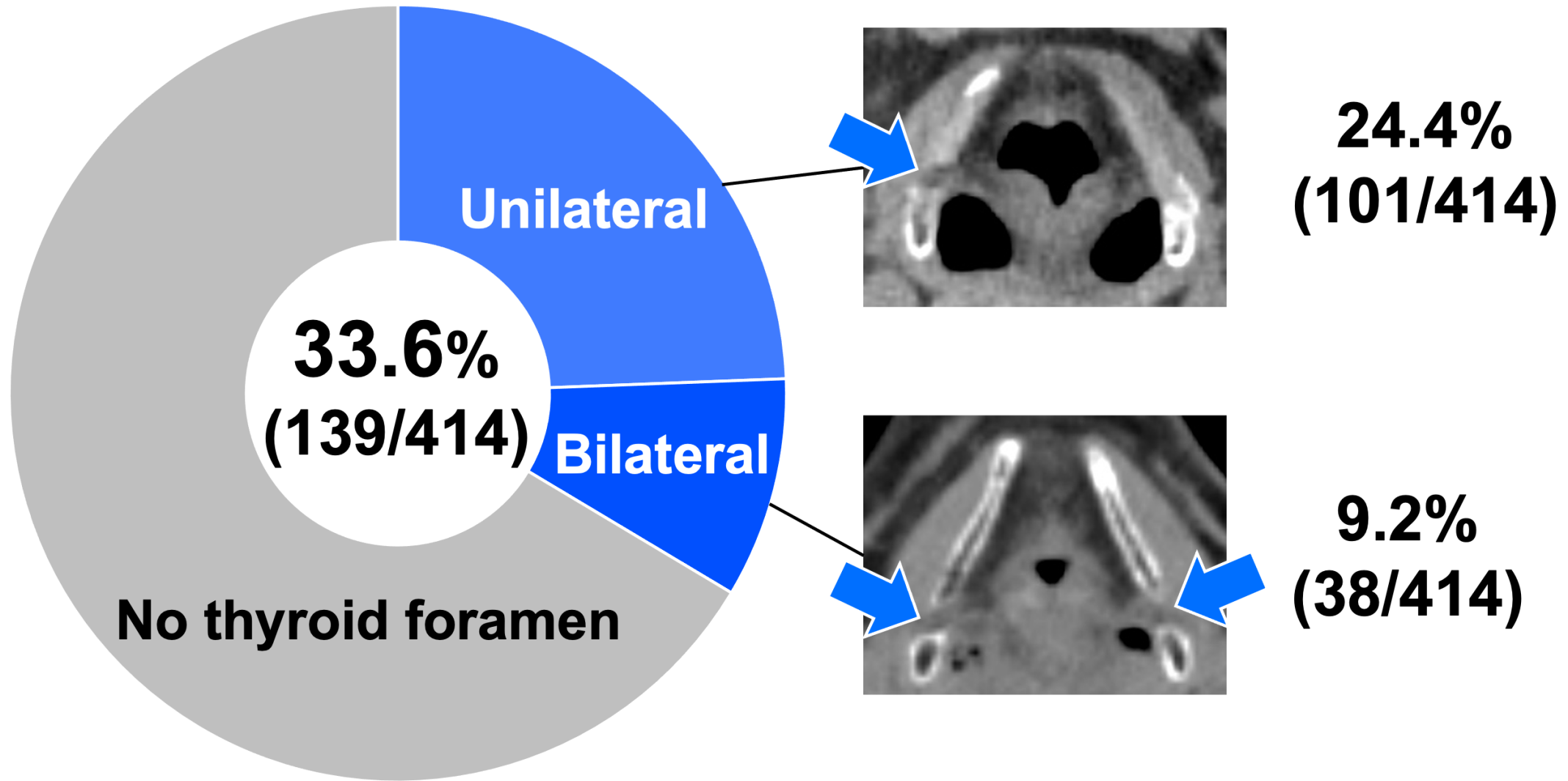
thyroid foramen with
Superior laryngeal artery passage

thyroid foramen without
Superior laryngeal artery passage

Morphology: Chi-square test

Size: Mann–Whitney U test

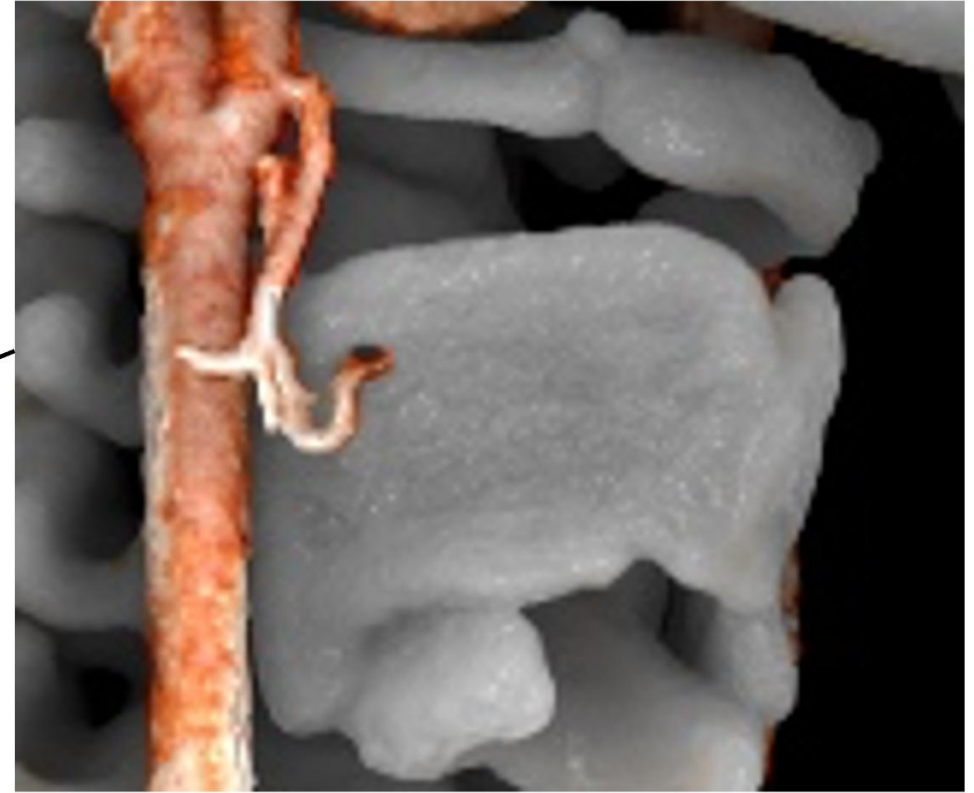
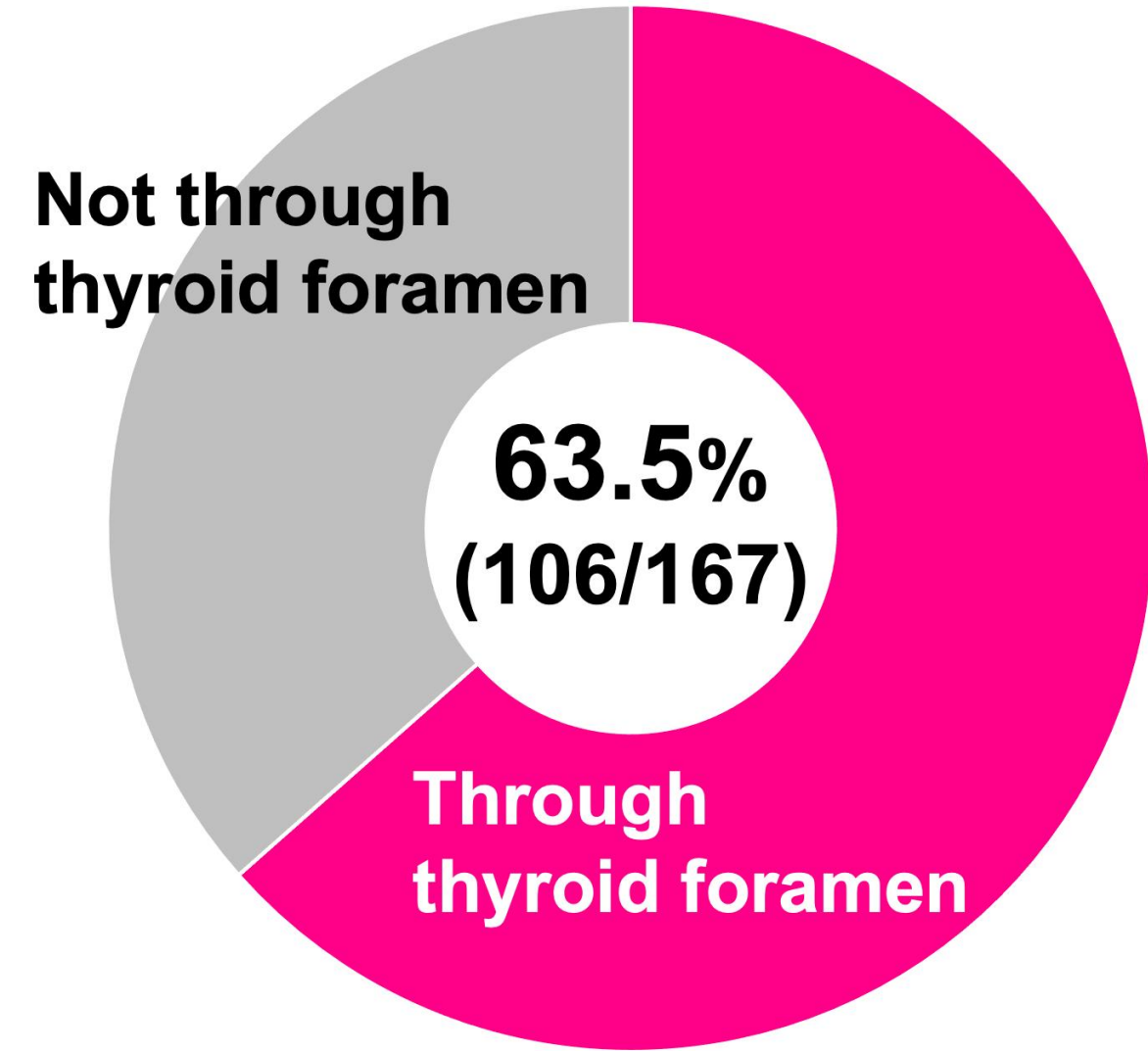
Results **Thyroid foramen** prevalence



177 thyroid foramina detected

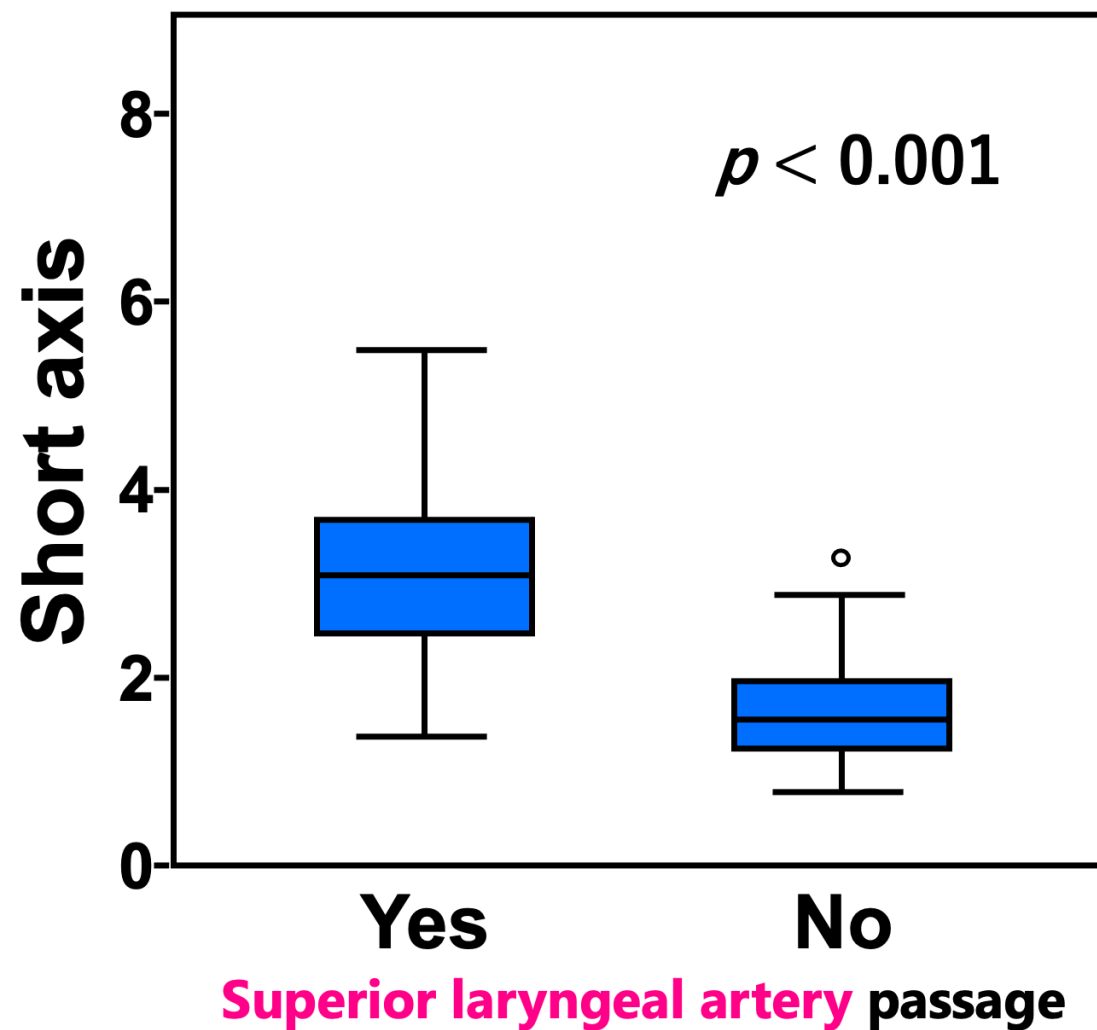
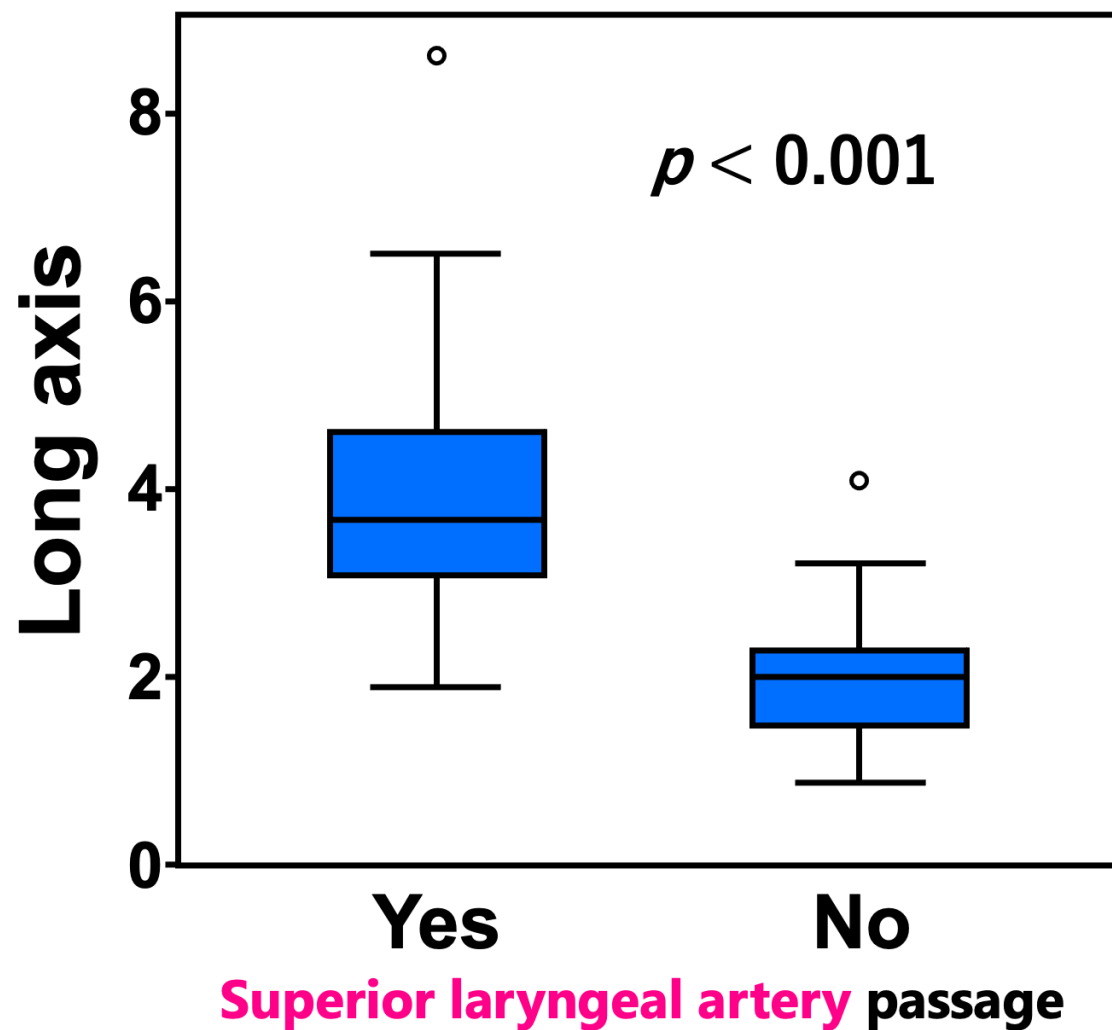
Results

Superior laryngeal artery

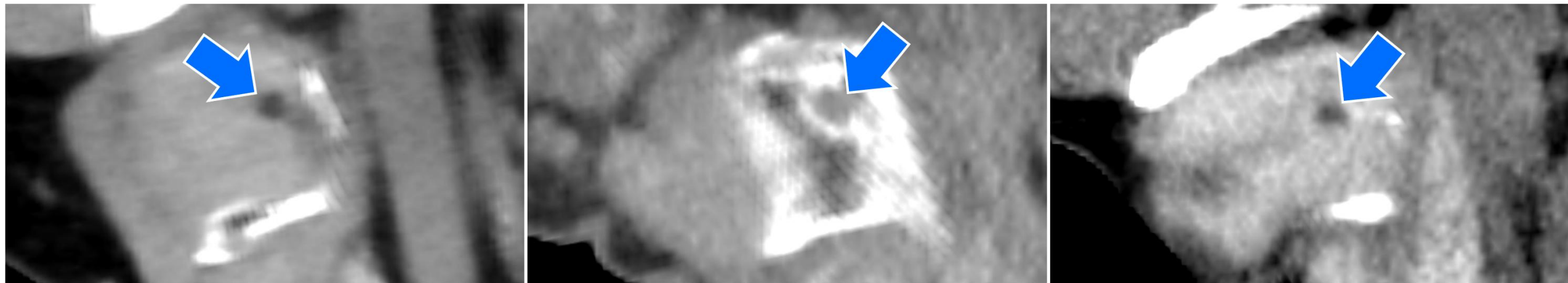


Results

Size of Thyroid foramen



Results Morphology of **Thyroid foramen**



● **Circular**

53.9%
(41/76)

● **Oval**

65.6%
(40/61)

☾ **Crescent**

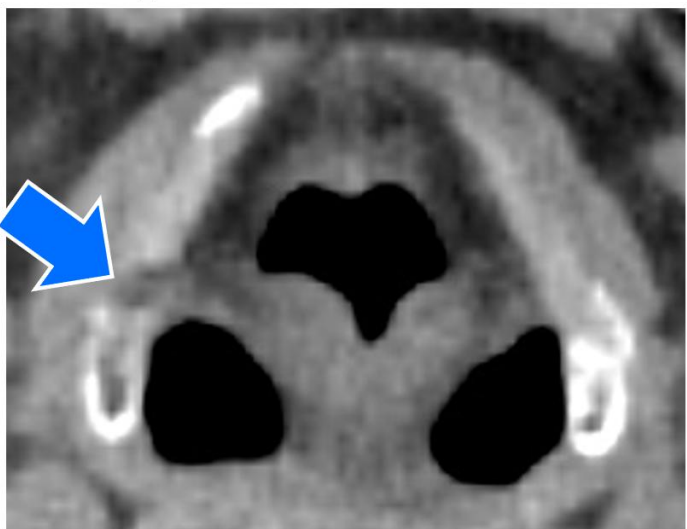
85.2%
(25/30)

Superior laryngeal artery passage differed by morphology

Results

Key results summary

Thyroid foramen prevalence



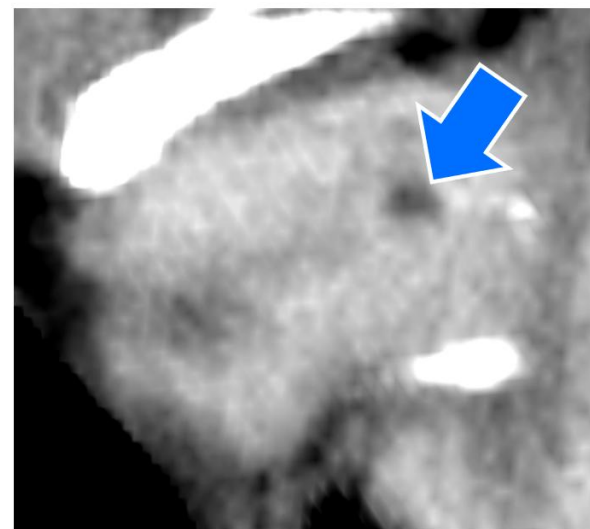
33.6%
(139/414)

Superior laryngeal artery passage



63.5%
(106/167)

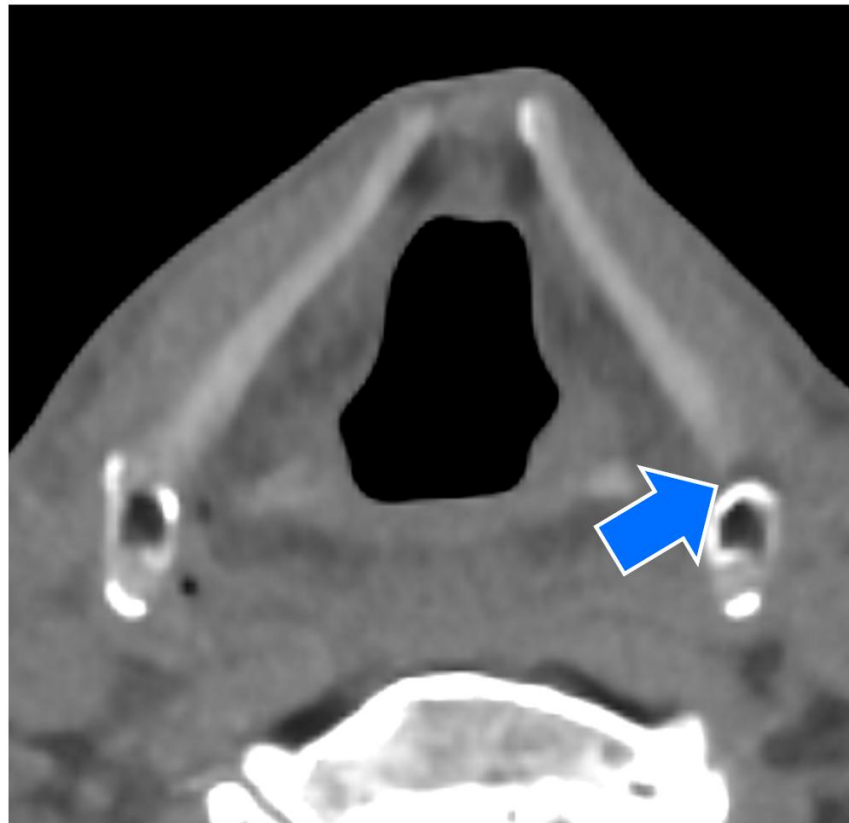
Size/morphology



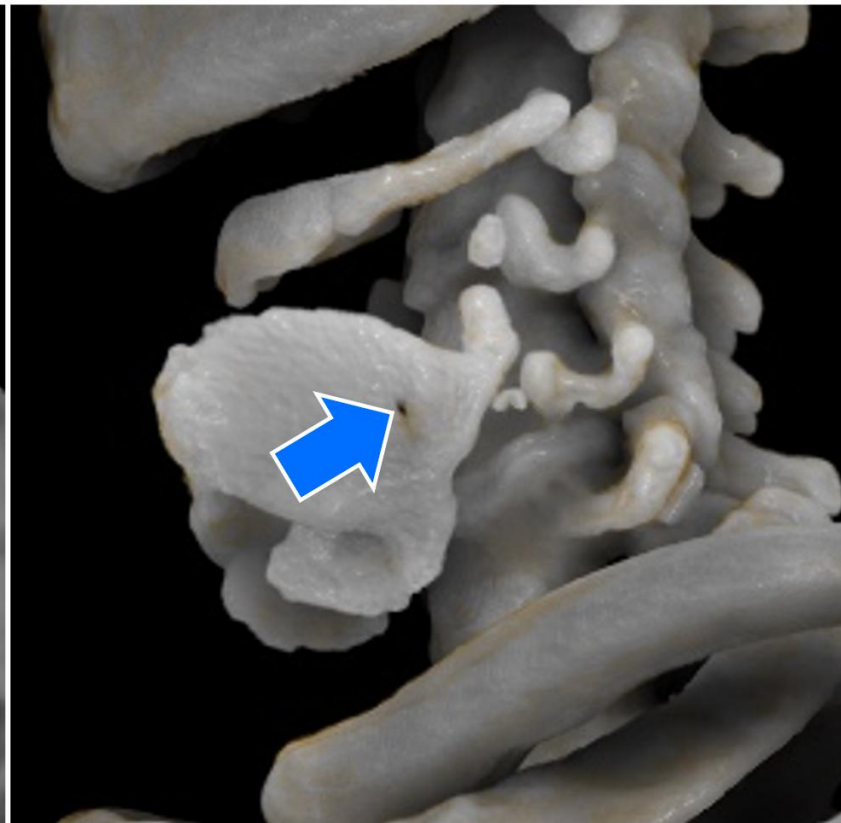
Large/crescent
shape suggests
arterial passage

Thyroid foramen can indicate arterial passage

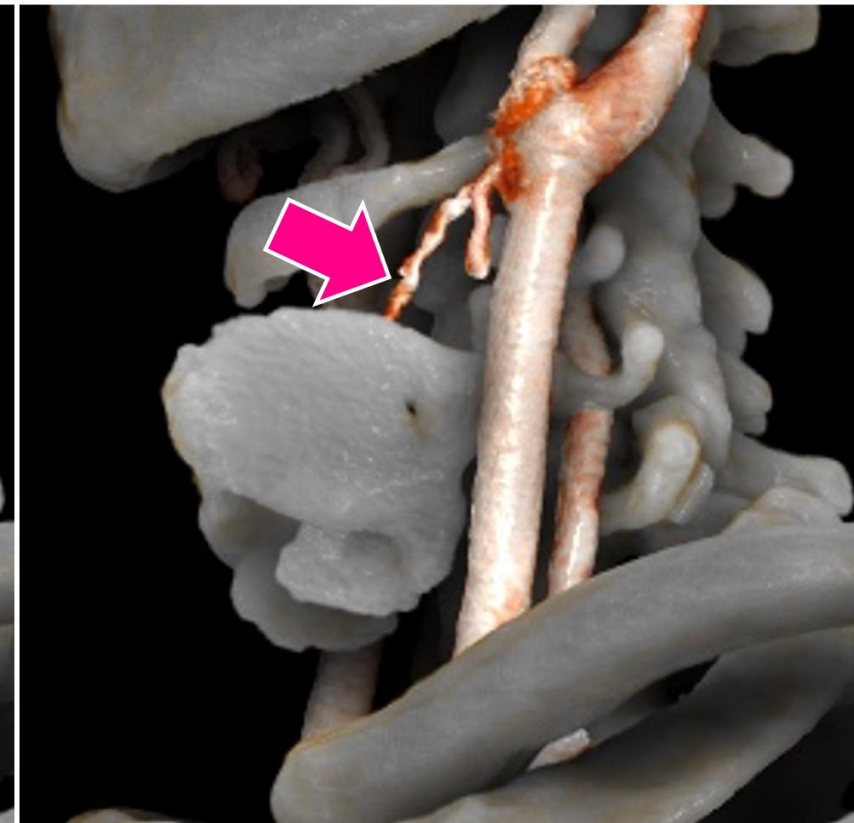
Representative case: 80s Male



1.1 x 1.1mm

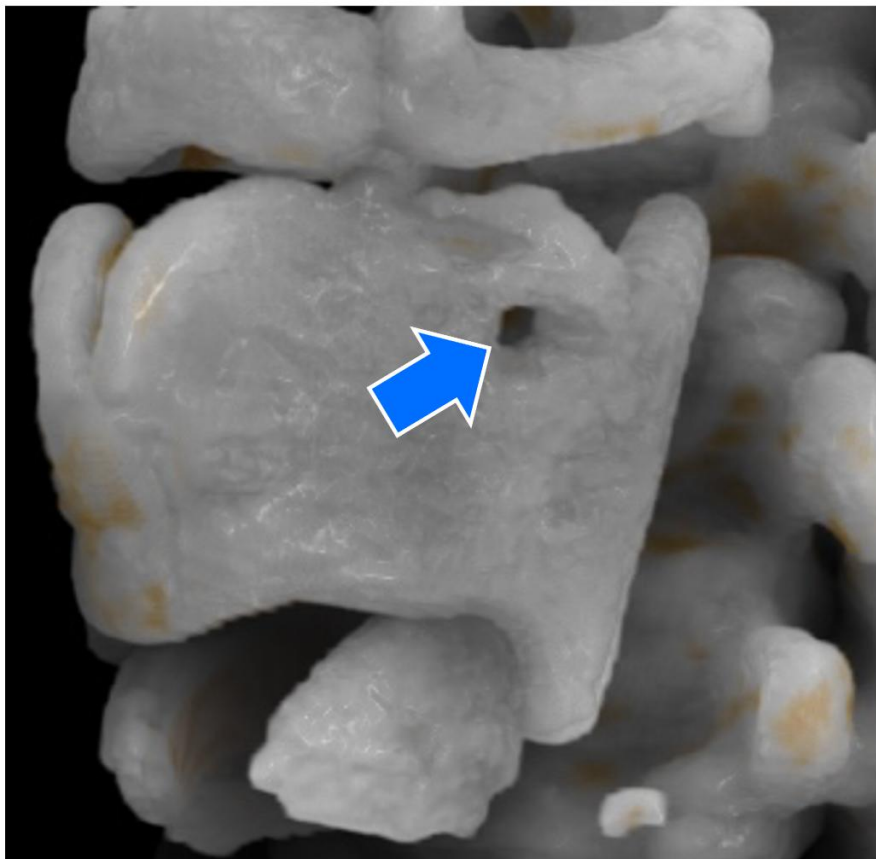


Circular

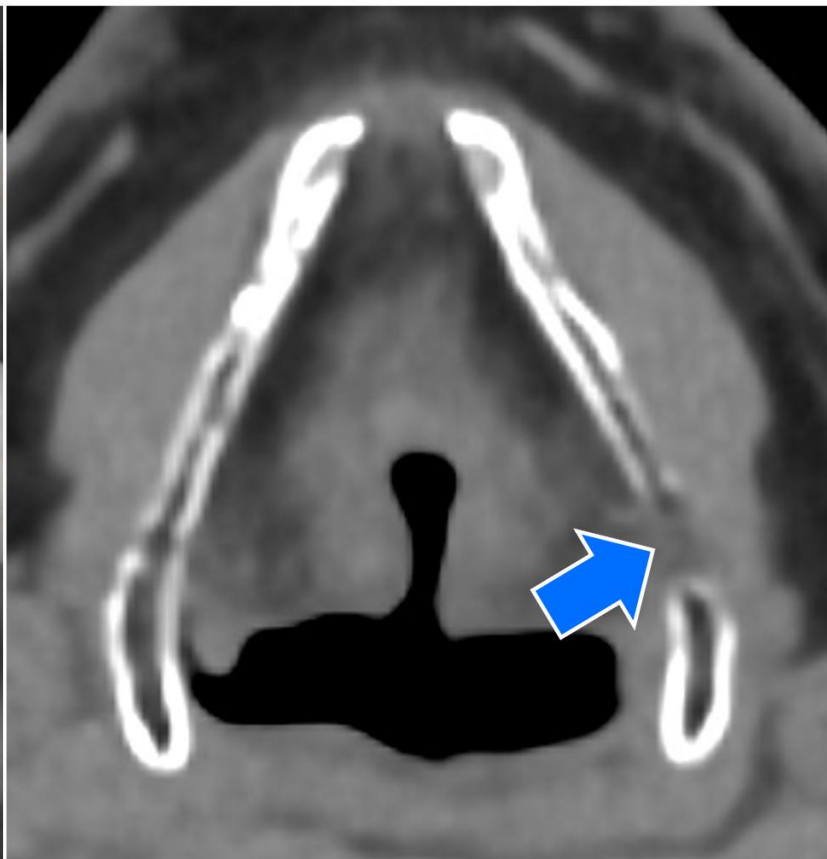


**Not through
thyroid foramen**

Representative case: 60s Male



3.8 x 2.5mm



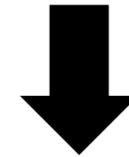
Oval



**Through
thyroid foramen**

From CT detection to vascular interpretation

Our previous CT study
Thyroid foramen is visible on CT



Present study
It may indicate **arterial** passage

Original Investigation Thyroid Foramen: Prevalence and CT Morphology¹

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Radiological implication

Non-contrast CT

Find the foramen



Arterial-phase CT

Trace the artery



May help avoid diagnostic pitfalls
and support surgical risk management

Conclusion

- **Thyroid foramen** was common.
- **Superior laryngeal artery** frequently passed through it.
- Large or crescent-shaped **thyroid foramina** may suggest **arterial** passage.
- Awareness of this anatomy may help avoid diagnostic pitfalls and support surgical risk management.

Tak for opmærksomheden

