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Urgent Carotid Angioplasty via the Ulnar Artery in Bovine Arch Anatomy: A Case Report

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Abstract

Background: Unusual aortic arch variants such as the bovine arch configuration can complicate carotid revascularization, often limiting the effectiveness of standard femoral access. Radial access is an established alternative, but data on ulnar access in neurovascular interventions remain scarce. We report a case of urgent left internal carotid artery angioplasty successfully performed via the ulnar artery after failed radial and femoral attempts, highlighting the feasibility of this approach in challenging anatomy.

Case Presentation: A 63-year-old man initially presented with suspected right-sided hemiparesis, with a normal supra-aortic Doppler ultrasound. One month later, he was readmitted for headache; brain CT revealed a right frontal hemorrhagic lesion, and CT angiography showed left internal carotid sub-occlusion due to a soft plaque, critical right internal carotid stenosis, and a type 2 bovine aortic arch. Due to hostile neck anatomy and high carotid bifurcation, percutaneous endovascular treatment was chosen over surgery. Initial radial access was not feasible, and femoral access provided inadequate support. Ulnar access was therefore obtained, enabling favorable navigation and deep catheter engagement. A dual-layer micromesh stent was deployed with distal filter protection, achieving successful revascularization and preserved hand perfusion. The patient showed neurological recovery during follow-up.

Conclusions: This case illustrates the ulnar artery as a safe and effective alternative vascular access for carotid angioplasty when both radial and femoral approaches fail, even in the absence of a palpable radial pulse. It emphasizes the potential of ulnar access to expand treatment options in complex arch anatomies and supports its consideration in selected urgent neurovascular interventions.

Keywords: Carotid angioplasty; Bovine arch anatomy; Ulnar artery access; Carotid stenosis; Stroke; Endovascular intervention

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Case Report

A 63-year-old man initially presented to the Emergency Department of Mater Salutis Hospital (Legnago, VR) for suspected right-sided hemiparesis; at that time, only a supra-aortic Doppler ultrasound was performed and was reported as normal. One month later, he was readmitted for headache, and brain CT revealed a right frontal hemorrhagic lesion (Fig 1a). CT angiography demonstrated sub-occlusion of the left internal carotid artery due to a soft plaque (Fig 1b), critical stenosis of the right internal carotid artery, and a type 2 bovine aortic arch (common origin of brachiocephalic and left common carotid (Fig 1c).

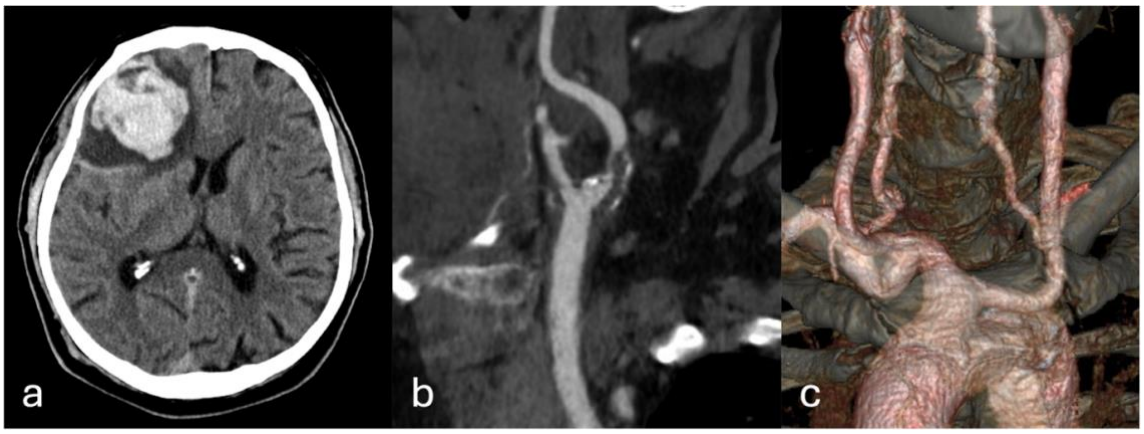

Figure 1: CT scan showing the hemorrhagic lesion in the right frontal lobe **(A)** CT angiography showing a sub-occlusion of the left internal carotid artery **(B)** and the bovine type 2 aortic arch anatomy **(C)**.

During hospitalization, he experienced a recurrence of right-sided hemiparesis. In light of the recurrent symptoms, carotid revascularization was indicated and planned after resolution of the hemorrhagic lesion (approximately 4 weeks after initial detection). Due to hostile neck anatomy and high carotid bifurcation, percutaneous endovascular treatment was chosen over surgery. In the Cath lab, carotid angiography confirmed the CT findings. The patient was agitated, which complicated the procedure. An initial attempt via the right radial artery failed, likely due to spasm or an anatomical variant. A femoral approach was then attempted but provided limited support due to the patient's anatomy (bovine arch and steep angulation, Fig 2, red line). A "child-in-mother" technique using a coronary guide extension catheter was adopted to advance a Judkins Right (JR) guiding catheter beyond the second arch curve, with only partial success. An Emboshield filter (Abbot) and guidewire were placed distally. However, during stent deployment, patient movement led to loss of guiding catheter position and unintentional stent deployment in the common carotid artery, with fortunately, no hemodynamic complications (Fig. 3, femoral sequence, a-b-c). To improve support, after performing a normal Allen test, an ulnar artery approach was then performed (Fig 2, blue line), despite the absence of a palpable radial pulse, which raised concerns about potential hand ischemia in case of ulnar artery injury. Using the new approach, navigation from the brachiocephalic trunk to the common carotid artery was more favorable, allowing deep engagement with a 7 Fr internal mammary catheter near the carotid bifurcation (Fig. 3, ulnar sequence, a-b-c). After placement of a new Emboshield filter, a dual layer micromesh stent (RoadSaver 8 × 40 mm, Terumo) was deployed from the bifurcation to internal carotid artery and post-dilated with a 5.5 × 15 mm balloon (Aviator, Cordis), achieving a good final angiographic result.

During the procedure, unfractionated heparin (UFH) was administered at a dose of 100 IU/kg.

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As the previous hemorrhagic lesion had resolved, periprocedural antiplatelet management was standard, consisting of dual antiplatelet therapy with aspirin and clopidogrel for 3 months than ASA longlife. A stepwise decompression of the ulnar artery (TR Band, Terumo) was performed in the subsequent hours to minimize the risk of occlusion. In the following days, the patient showed recovery from neurological symptoms.

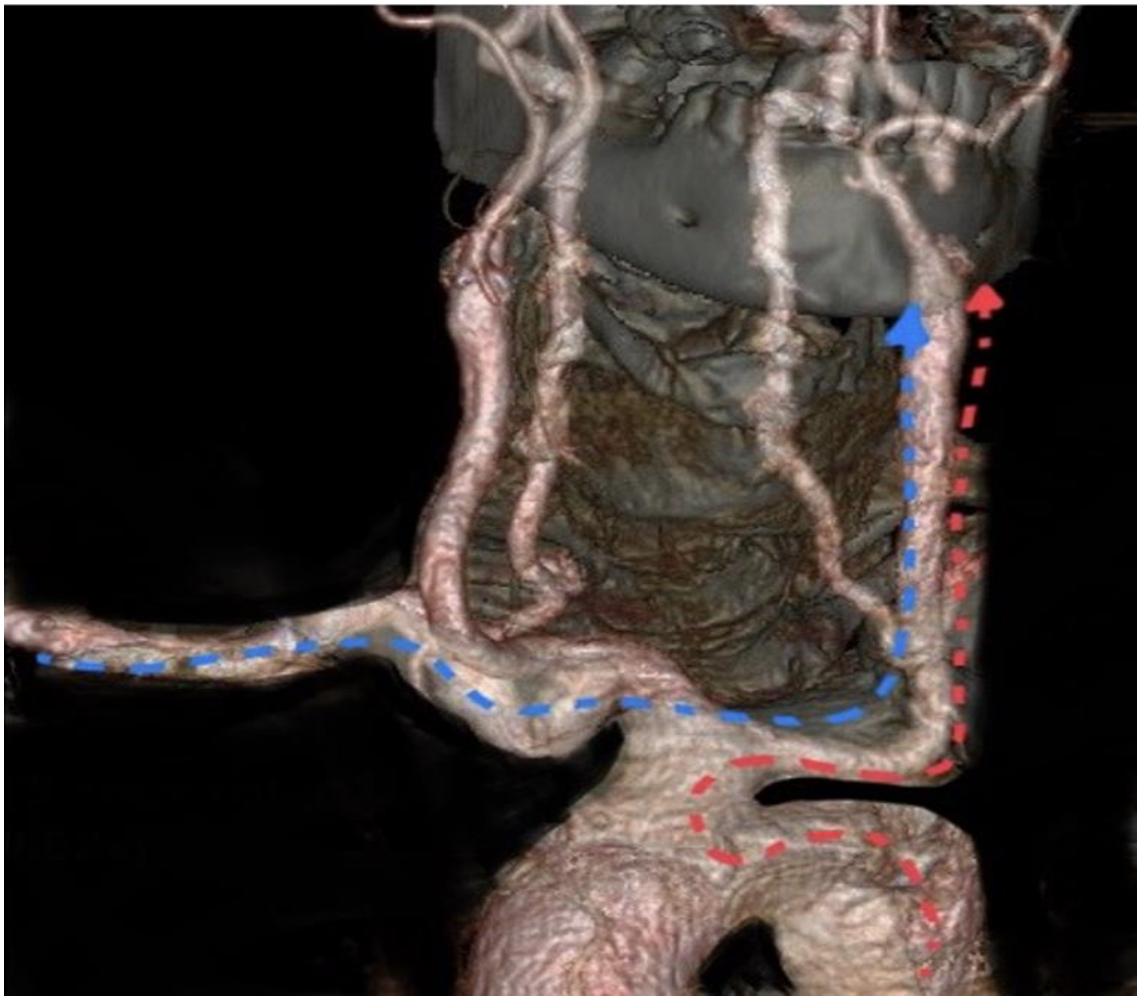

Figure 2: Procedural planning. A femoral approach was first attempted but provided limited support due to the patient's anatomy (bovine arch and steep angulation, Red line). The ulnar artery approach that was successfully performed subsequently (Blue line).

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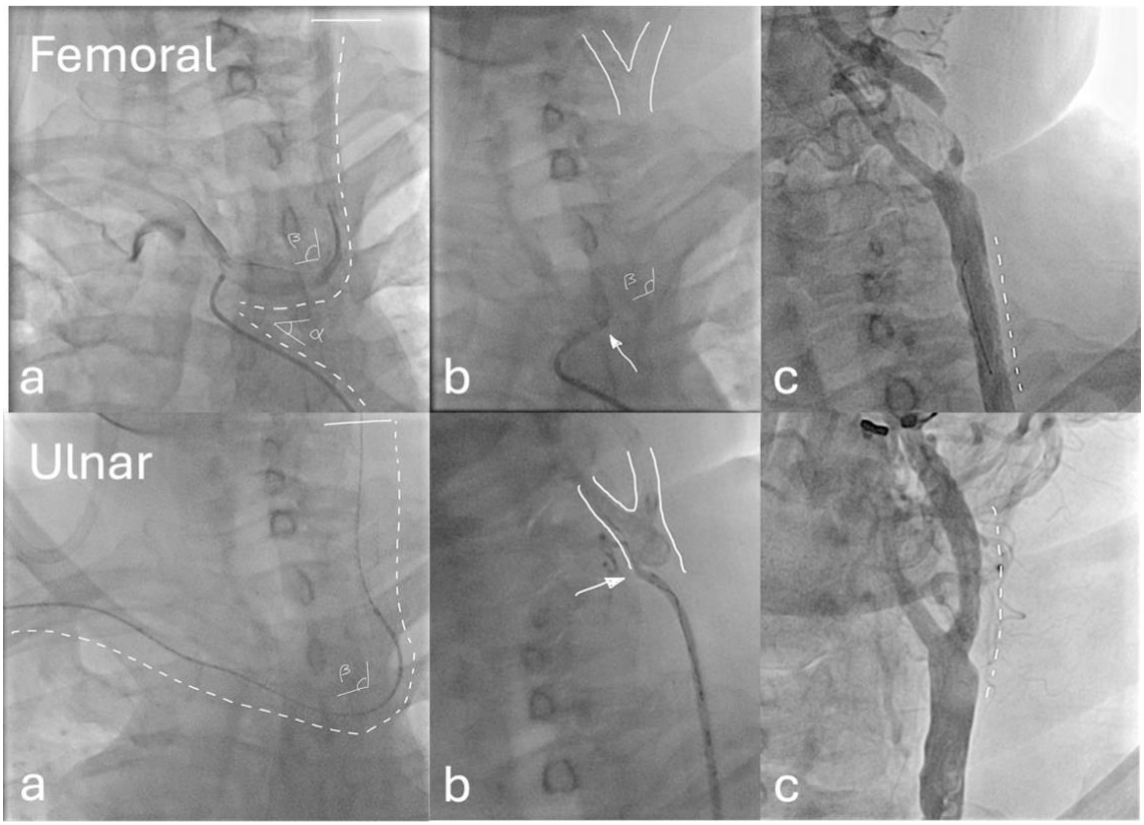

Figure 3: Femoral approach (A, B, C in the upper boxes): During stent deployment, patient movement led to loss of guiding catheter position and unintentional stent deployment in the common carotid artery. **Ulnar approach (A, B, C in the lower boxes):** Using the new approach, navigation from the brachiocephalic trunk to the common carotid artery was more favorable, allowing deep engagement with a 7 Fr internal mammary catheter near the carotid bifurcation and correct stent deployment.

Discussion

The bovine arch configuration [5] presents a challenge for endovascular treatment of the left internal carotid artery. The radial approach has been proposed as a way to improve support compared to the classic femoral access. The ulnar approach has also been suggested as a safe and effective alternative, first in coronary procedures and subsequently in neuroradiology [1]. Despite concerns about hand perfusion, particularly if the ulnar artery is damaged, available evidence reported safety of this access also when radial access is absent or occluded [2]. Regarding this, in percutaneous coronary interventions, the ulnar approach has been widely explored as a viable alternative to the radial route even in such scenarios, with encouraging results [2]. In neuro-radiology evidence is scarce and limited to case series and reports [3,4]. In our case, after a failed femoral attempt, our experience with similar settings during coronary procedures gave us confidence in the safety of ulnar artery access, even in the absence of palpable radial artery. Sheath size is important: a 7 Fr sheath, as used in our case, is relatively large for ulnar access but enables standard carotid devices. Pre-procedural assessment—including Allen test and artery diameter—ensures adequate hand perfusion. While rare, large-bore access carries a risk of compartment syndrome, which can be mitigated with careful post-procedural decompression protocols. The decision to use a gradual decompression technique post-procedure also stemmed from coronary intervention protocols and likely contributed to preserved hand perfusion.

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Conclusions

In the presented urgent case, the ulnar artery approach proved to be a viable alternative to the radial route for left internal carotid artery angioplasty in Bovine Arch Anatomy. Despite the absence of a radial pulse, hand perfusion was preserved, supporting existing evidence for the safety and feasibility of this access in selected cases.

Declarations

Ethics declarations and consent for publication: The patient provided written informed consent for the publication of this case report and related images.

Availability of data and materials: This study did not generate or analyze datasets; consequently, data sharing is not applicable.

Conflict of interest: The authors declare no conflicts of interest related to this work.

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Authors Contributions:

Gabriele Venturi: Conceptualization, first draft, interventional procedure, supervision.

Luca Bonizzi: Writing, review & editing.

Mattia Zanoni, Alessandra Danese, Michelangelo Turazzini: Neurological evaluation, data interpretation, manuscript review.

Alberto Zamboni, Giorgio Morando: Interventional support, clinical management, critical revision.

Ugo Navarro: Imaging expert guiding procedure planning.

Antonio Mugnolo: Senior oversight, final approval, coordination of the multidisciplinary team.

Running title: Urgent Carotid Angioplasty via the Ulnar Artery in Bovine Arch Anatomy.

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