



Interventional Neuroradiology I

Diagnostic Angiography

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Historic Excursion



- **1895:** Wilhelm Conrad Röntgen discovers the X- rays
- **1896:** The first angiography by Eduard Haschek et al. was reported in Vienna



Historic Excursion

- **23th Jan. 1896** is the hour of birth of *angiography*
- **Haschek and Lindenthal** presented the first angiogram of a human hand in Vienna
- after injecting a mixture of petroleum, quicklime and mercuric sulfide in the hand of a cadaver
- *Teichmann'sche Masse (Petroleum, Kalk, Zinnober)*



Historic Excursion



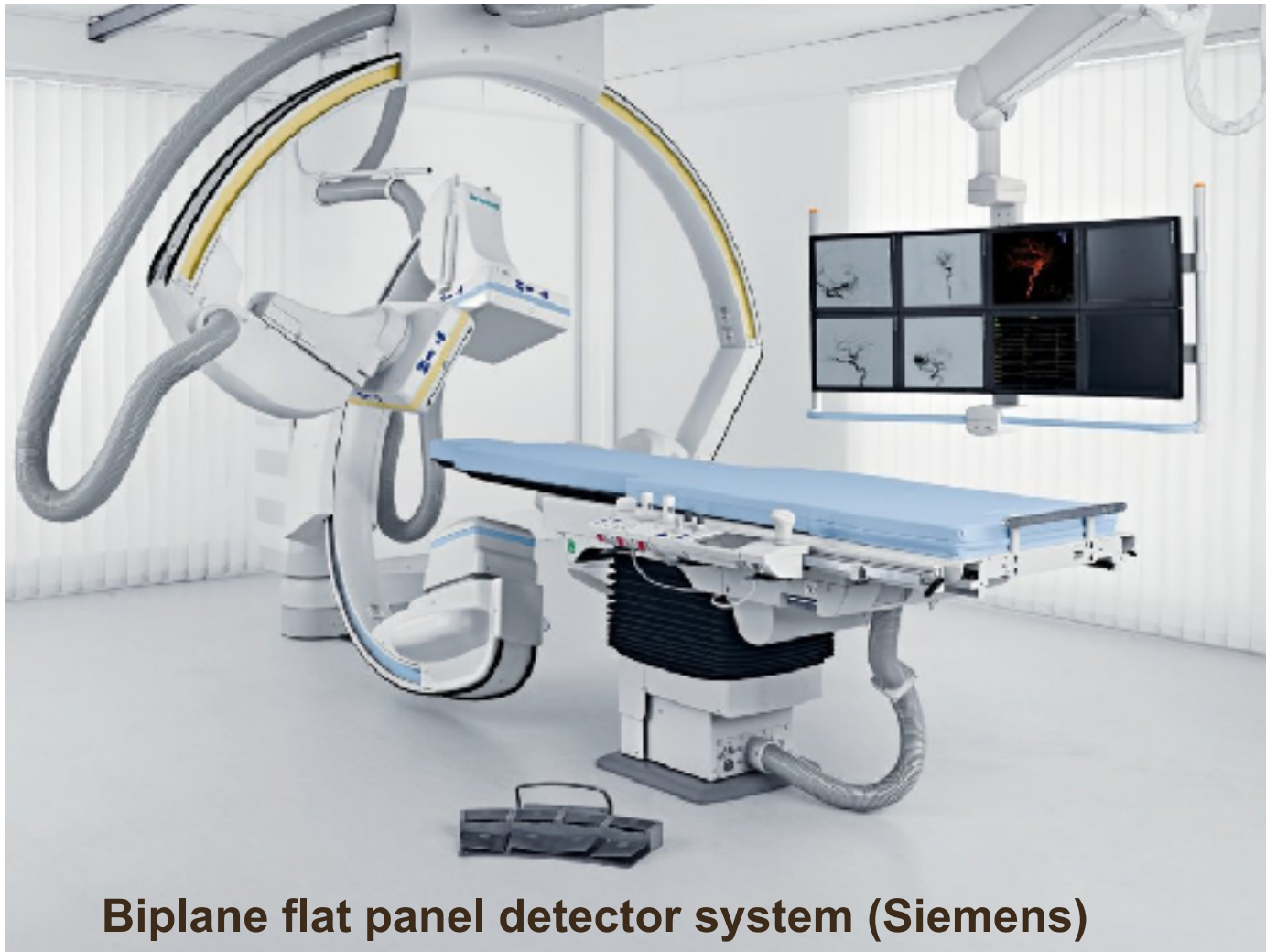
Antonio de Egas Moniz

- **1927:** First cerebral angiography in a living human
- by Antonio de Egas Moniz
- using bromide or sodium iodide
- **1931:** First (accidental) cerebral venogram by Moniz



The Exorcist (1973)

Angiography suite



Biplane flat panel detector system (Siemens)

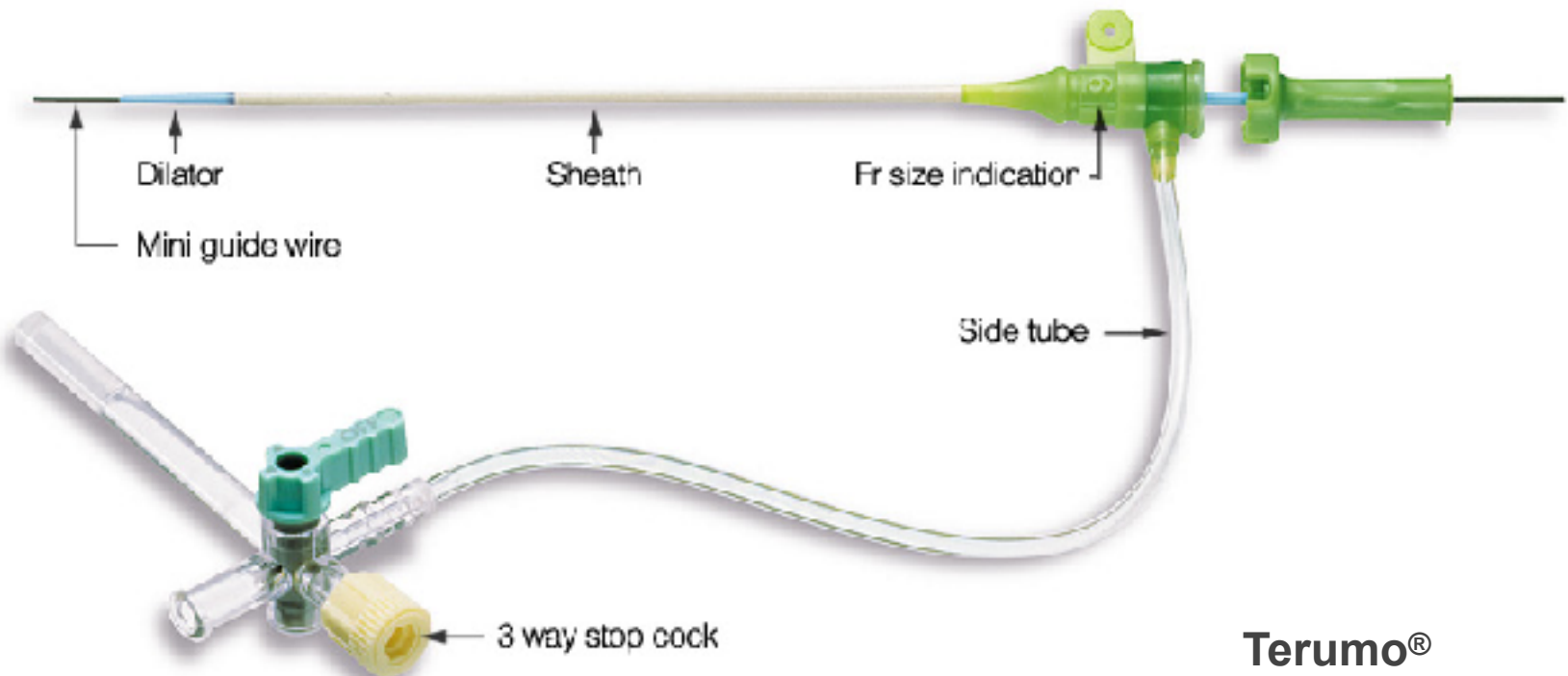


Materials and Measurement systems

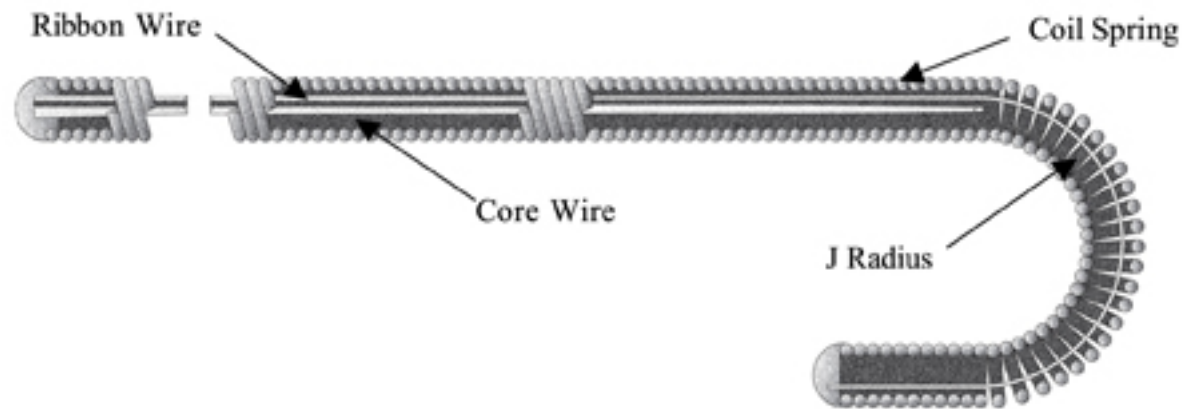
- **Needles**
 - diameter measured in **Gauge (= Gage)**
 - **Arterial sheath**
 - measured in **French** referring to the inner diameter
 - **Wires**
 - diameter measured in thousandths of an **inch**
 - **Catheters**
 - measured in **French** referring to the outer diameter
 - **Length** of all materials is measured in **cm**
-

Arterial puncture

- Puncture of femoral or cubital artery
- Insertion of an arterial sheath



Guide wires



Classic stainless steel wires consist of 3 major components:

1. Core wire
2. Ribbon wire
3. Coil spring

Arterial puncture

FROM THE ROENTGEN DIAGNOSTIC DEPARTMENT (DIRECTOR: PROFESSOR KNUT LINDBLOM),
KAROLINSKA SJUKHUSET, STOCKHOLM, SWEDEN

CATHETER REPLACEMENT OF THE NEEDLE IN PERCUTANEOUS ARTERIOGRAPHY

A new technique

by

Sven Ivar Seldinger

The catheter method of angiography has become more popular in the past few years, as it provides the following advantages over the method of injecting the contrast medium by means of a simple needle:

- 1) The contrast medium may be injected into a vessel at any level desired.
- 2) Risk of extravascular injection of the contrast medium is minimised.
- 3) The patient may be placed in any position required.
- 4) The catheter may be left in situ without risk while the films are being developed, thus facilitating re-examination if necessary.

Until recently, however, the use of the catheter method was restricted because of the lack of a suitable flexible thin-walled catheter which could be used percutaneously. FARINAS, in 1941, described a method in which a urethral catheter was passed up into the aorta through a trocar inserted in the exposed femoral artery. In 1947, RADNER catheterized the exposed and ligated radial artery and performed vertebral angiography and later thoracic aortography. Since then, many authors have catheterized arteries for various purposes, by surgical exposure followed by ligature or resuturing of the artery. In 1949, JÖNSSON performed thoracic aortography after puncture of the common carotid artery by means of a blunt cannula provided with an inner sharp needle. The cannula, guided by a silver thread, was then directed downwards. Later

Briefly presented at the Congress of the Northern Association of Medical Radiology, Helsinki, June, 1952; submitted for publication, October 28, 1952.

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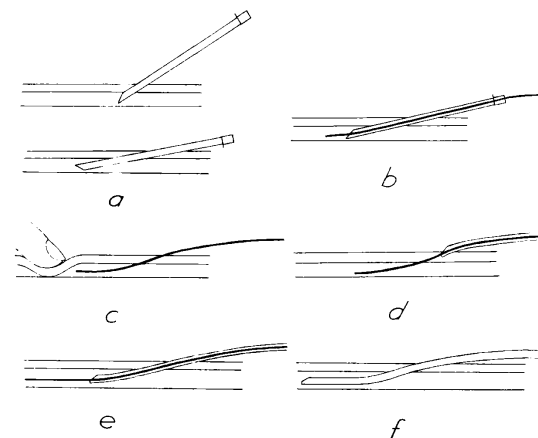


Fig. 2. Diagram of the technique used. a) The artery punctured. The needle pushed upwards. b) The leader inserted. c) The needle withdrawn and the artery compressed, d) The catheter threaded on to the leader. e) The catheter inserted into the artery. f) The leader withdrawn.

The leader should have a diameter slightly less than the bore of the needle and the catheter, so that it is capable of passing through both, and should be at least 8–9 cm longer than the latter; on the other hand it should just fit the lumen of the catheter (Fig. 1). The tip of the catheter may be cut before use as shown in Fig. 2.

Technique (see Fig. 2).

a) After local anaesthesia, the artery is punctured percutaneously at a relatively small angle.

After puncture it is best to rotate the needle 180° and push it a little into the artery using the bleeding as a guide to ensure that the needle remains in the artery. Puncture of arteries smaller than the femoral artery is facilitated by using an inner needle as a guide over which the outer needle is directed into the artery.

b) The supple tip of the leader is inserted a very short distance into the lumen of the artery through the needle.

c) The leader is held in place and the needle removed.

Arterial puncture

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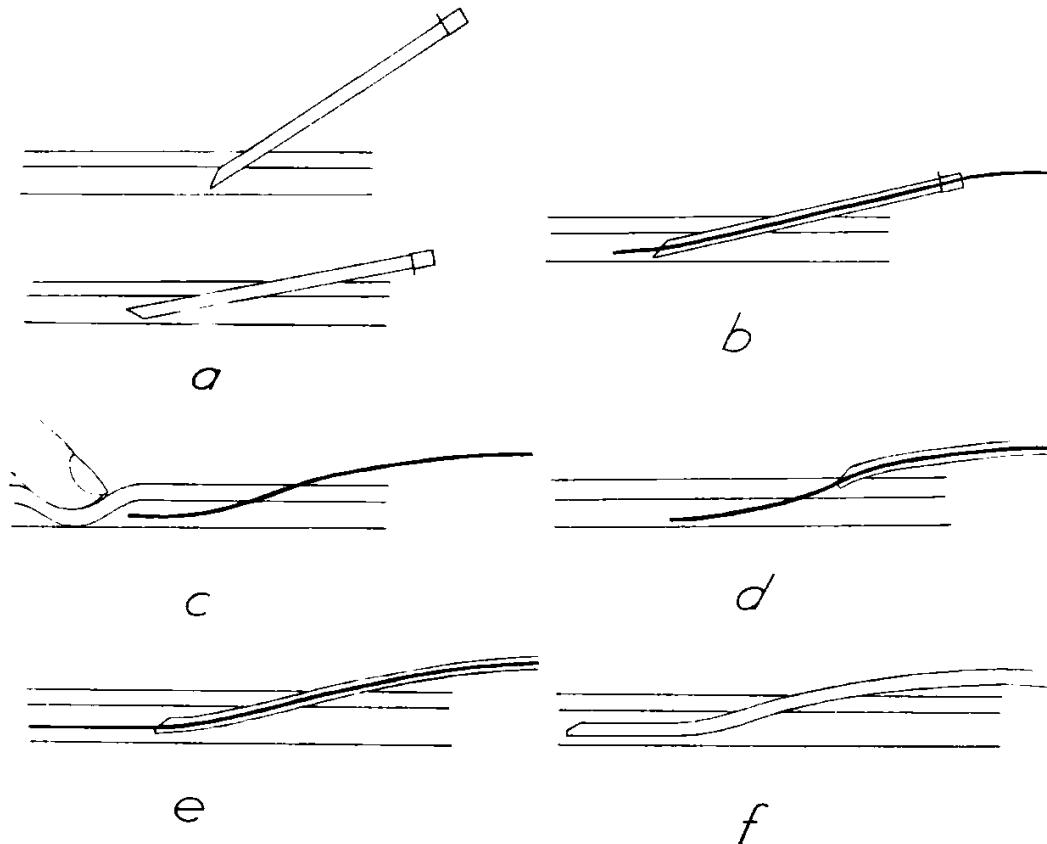
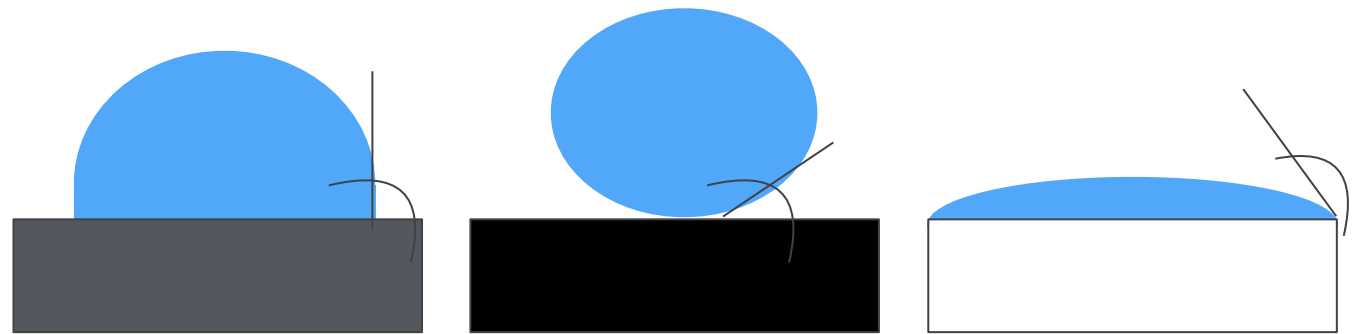


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Arterial puncture



Hydrophobic vs. hydrophilic



contact angle of water:

90°

$<90^\circ$

$>90^\circ$



Lubricity/ Reduction of friction

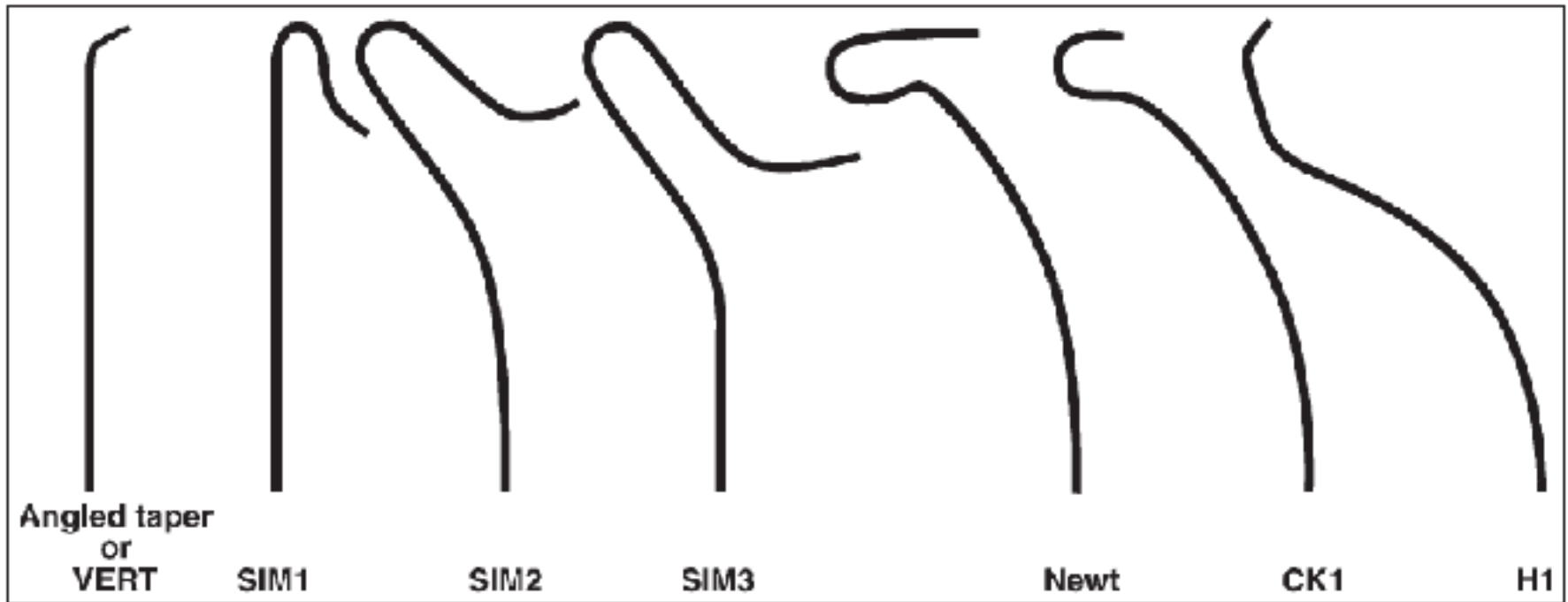
PTFE: 126° (Polytetrafluorethylen, Teflon)

Guide wires



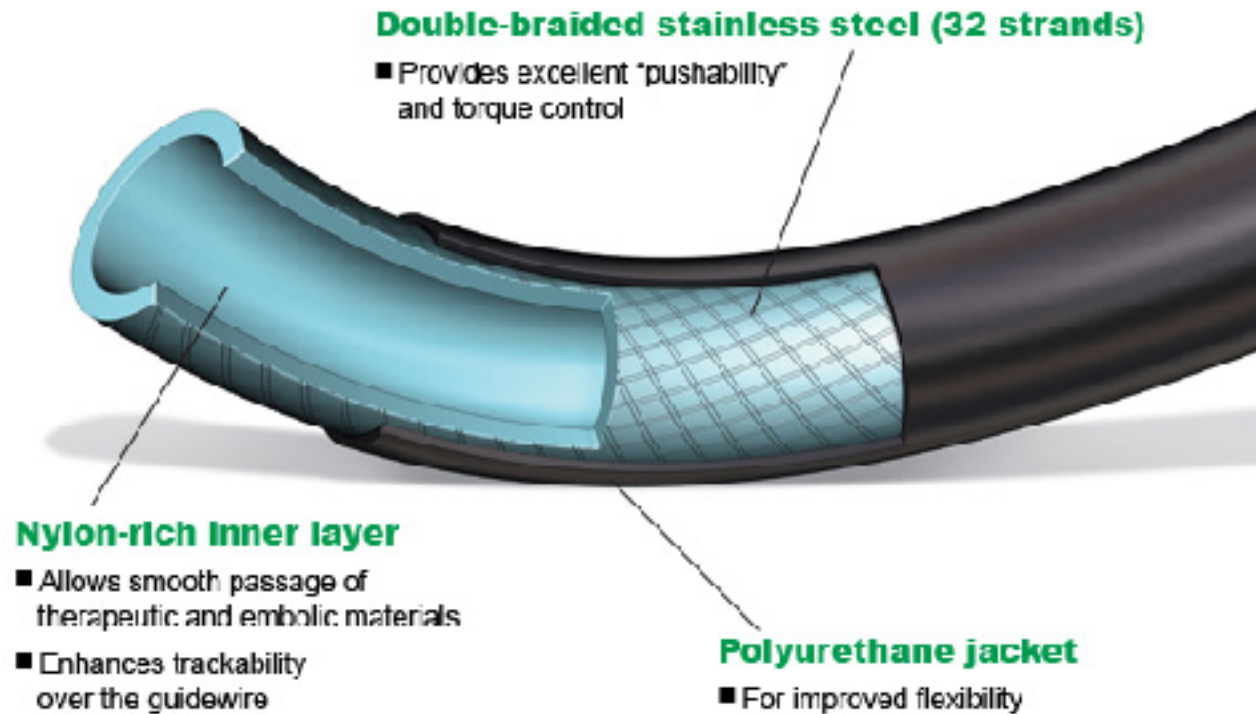
Terumo®

Catheters



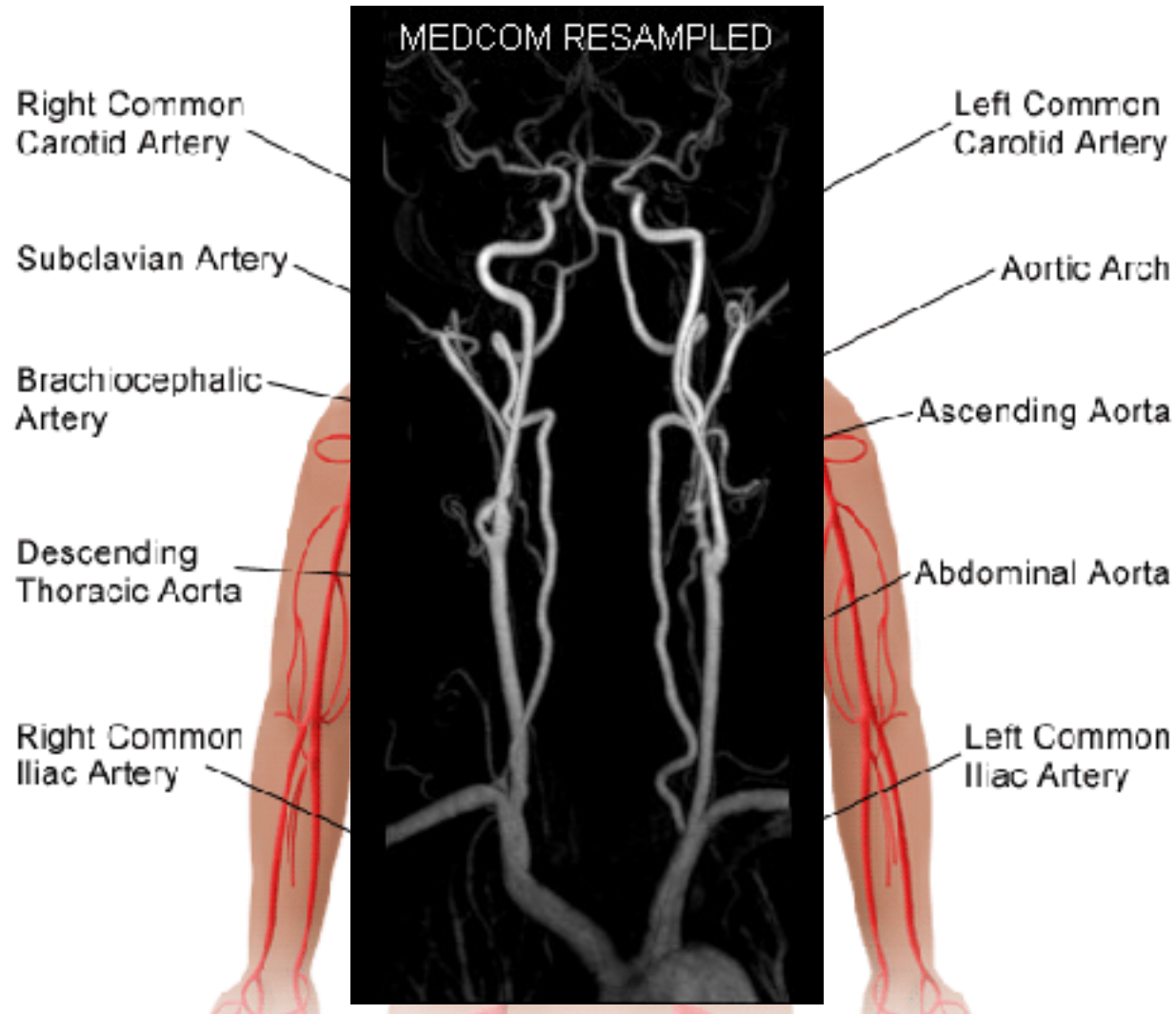
COOK®

Catheters

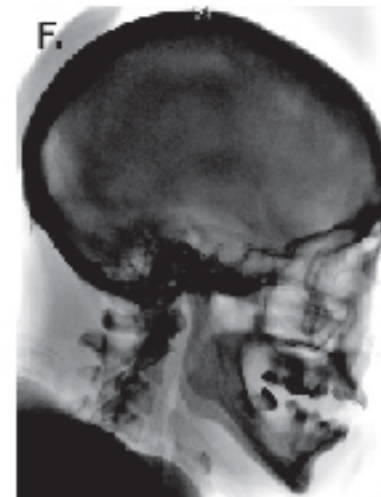
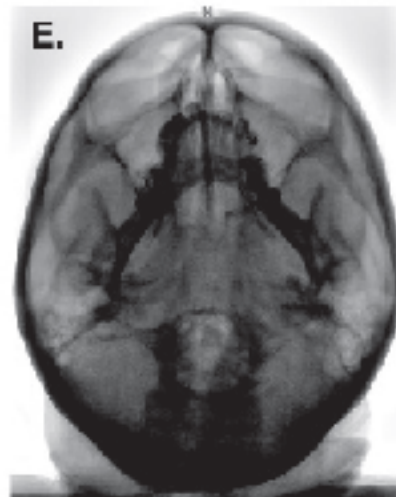
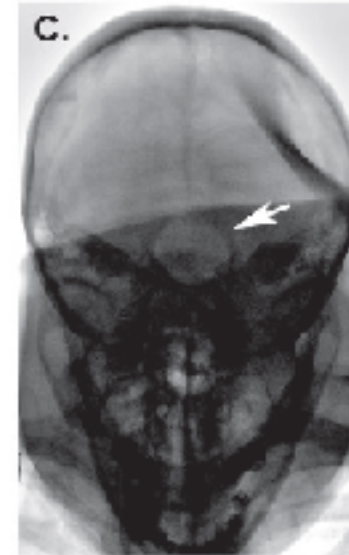
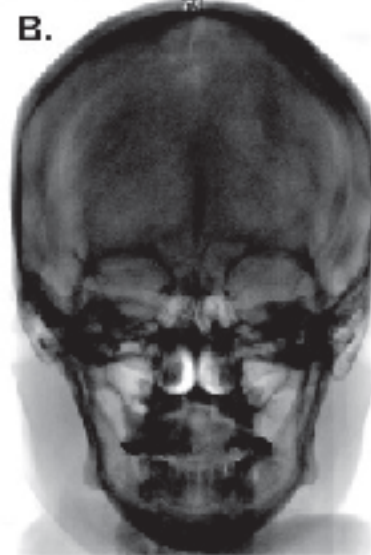


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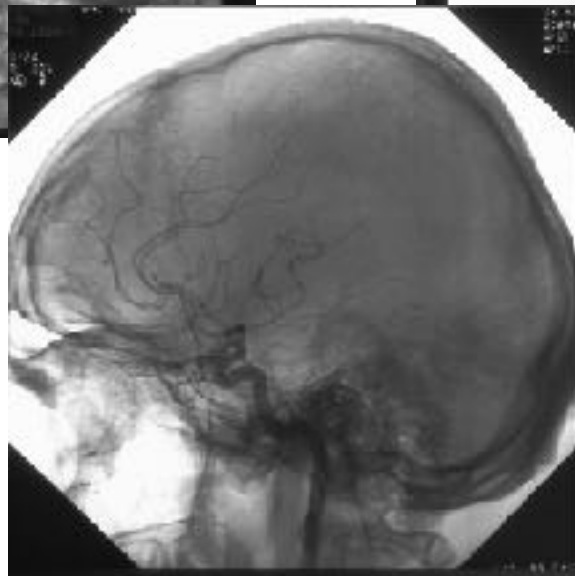
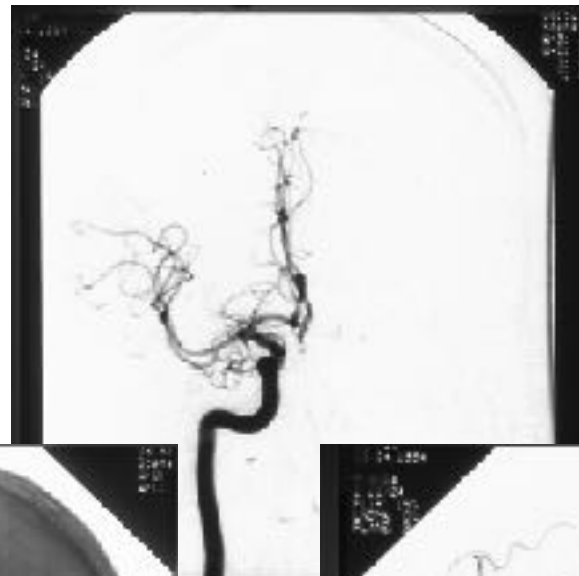
Anatomy



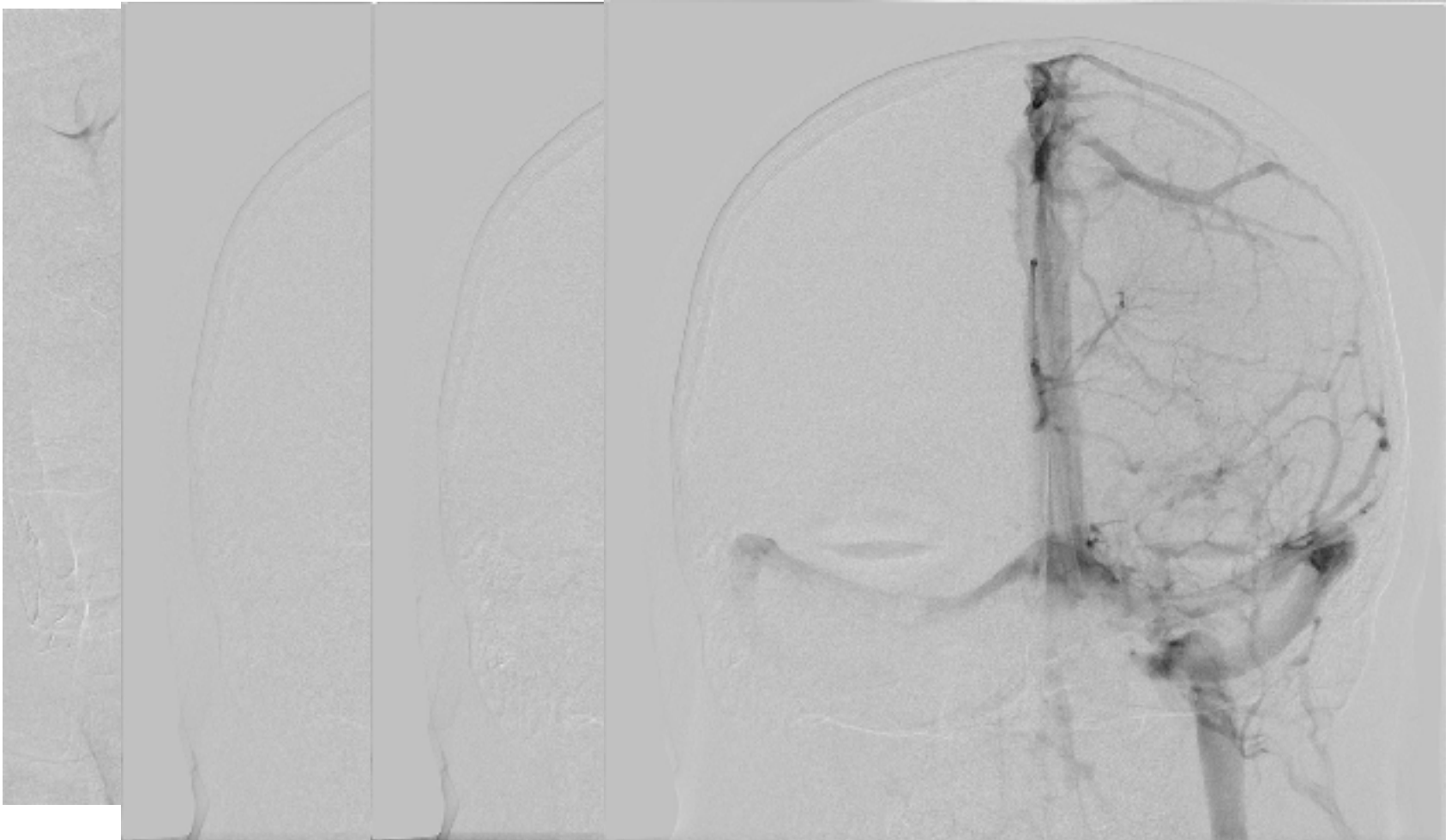
Standard views



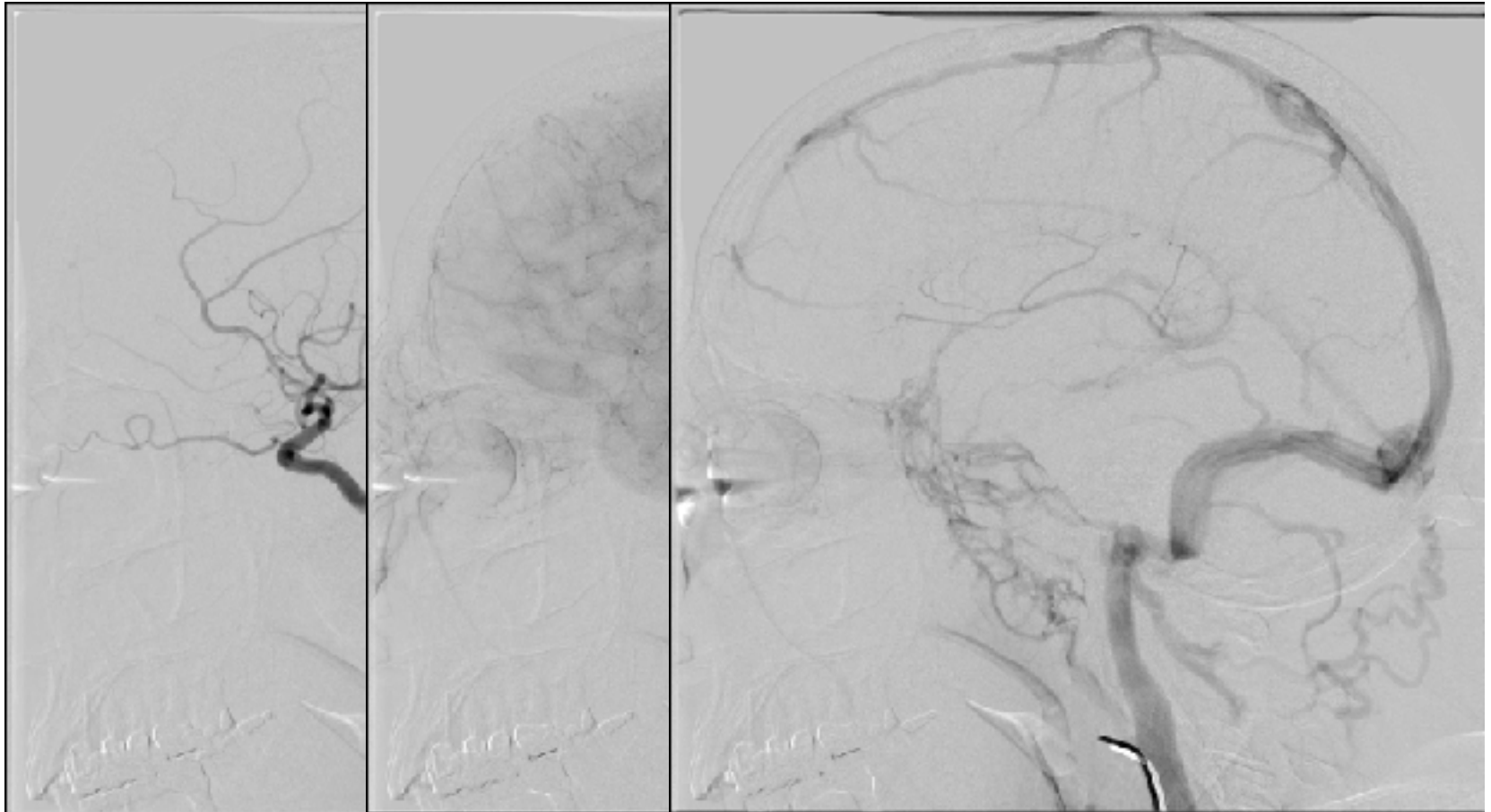
Digital subtraction angiography



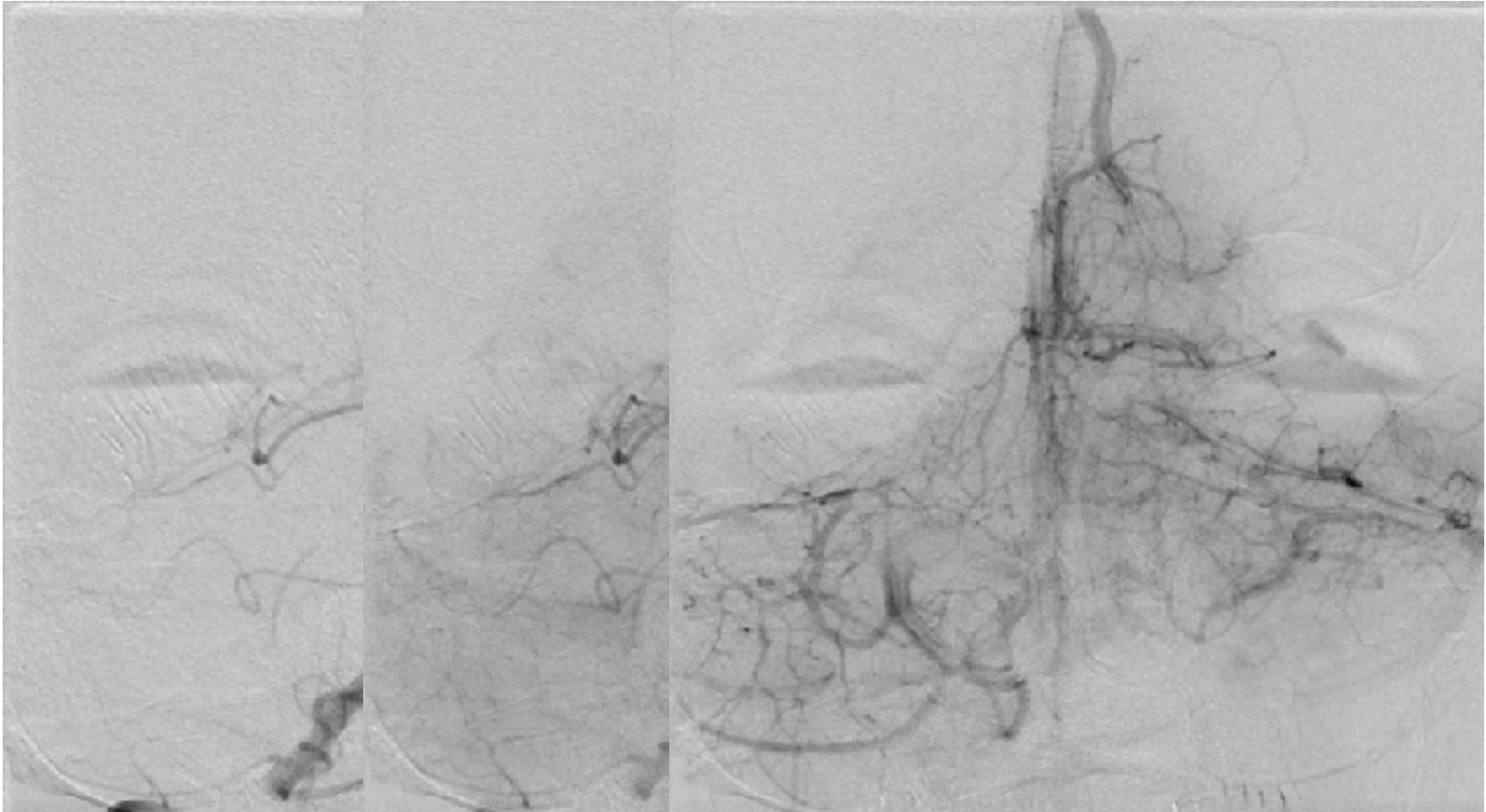
Normal angiogram of left internal carotid artery



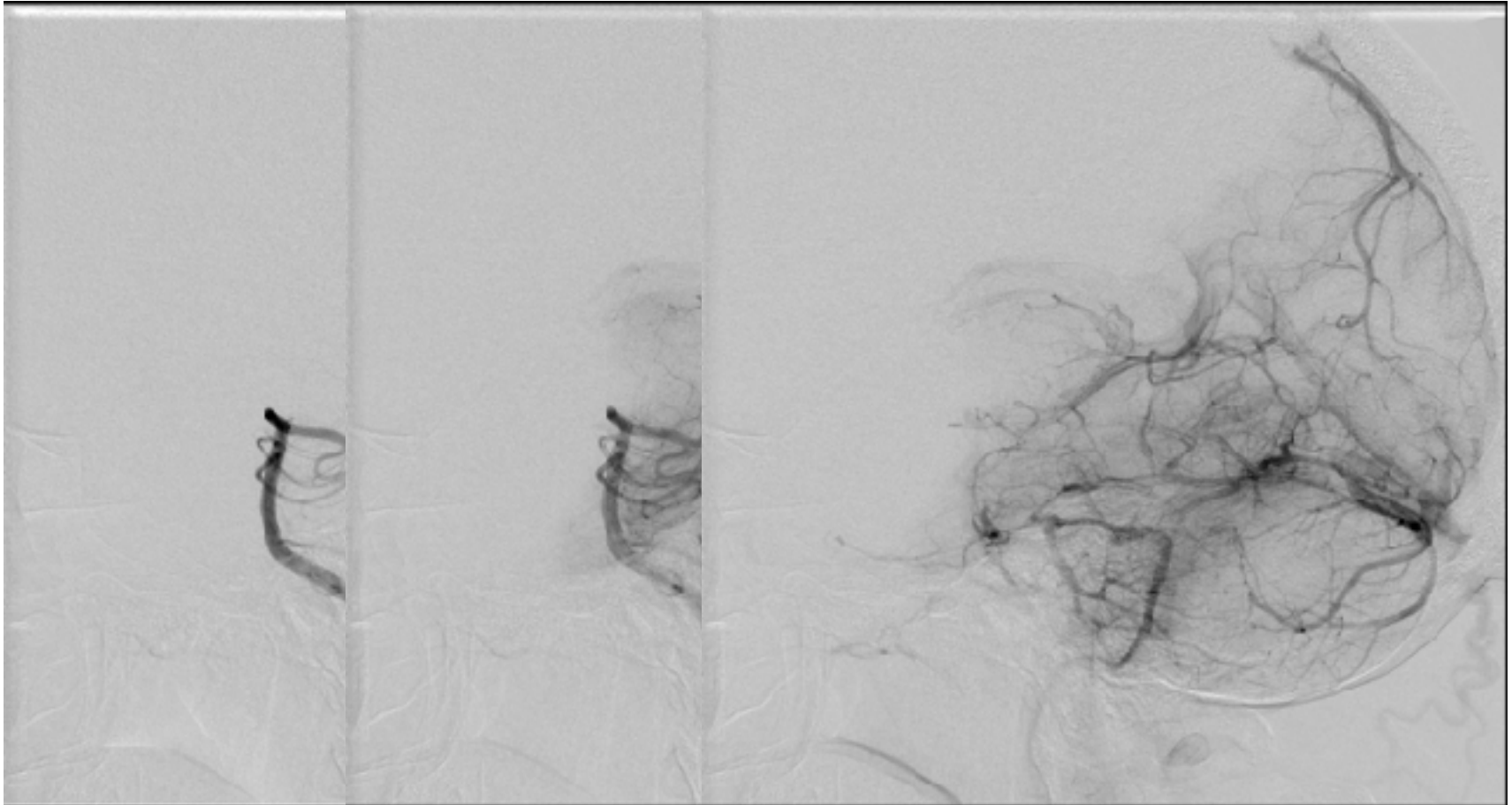
Normal angiogram of left internal carotid artery



Normal angiogram of right vertebral artery



Normal angiogram of right vertebral artery



Indications for diagnostic cerebral angiography

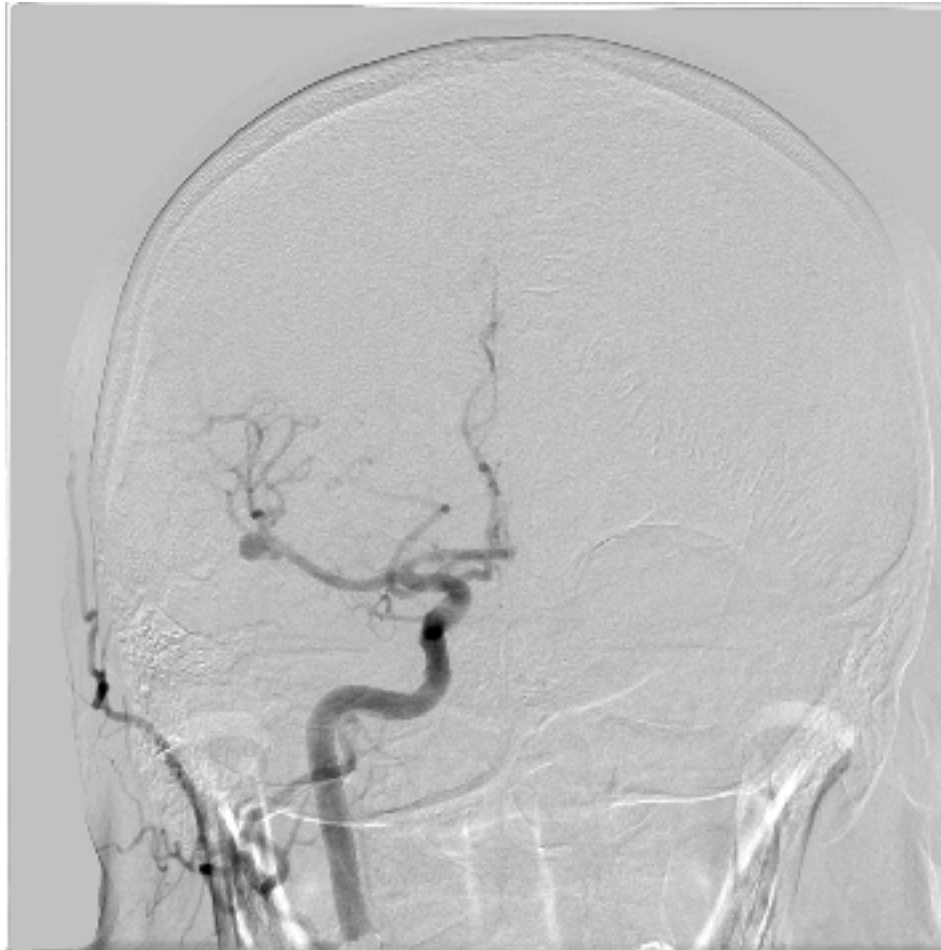
- **Neurovascular disease**
 - Intracranial aneurysm
 - cerebral vasospasm
 - atherosclerotic stenosis
 - acute ischemic stroke
 - atypical intracerebral hemorrhage
 - vasculopathy (vasculitis)
 - dural arteriovenous fistulas
 - arteriovenous malformations
 - venous sinus stenosis
 - **Planning for neurointerventional procedures**
 - tumor embolization
 - **Follow-up imaging after treatment**
 - **Others**
 - prior to hypophyseal surgery
 - sinus petrosus blood examination
-

What is wrong?



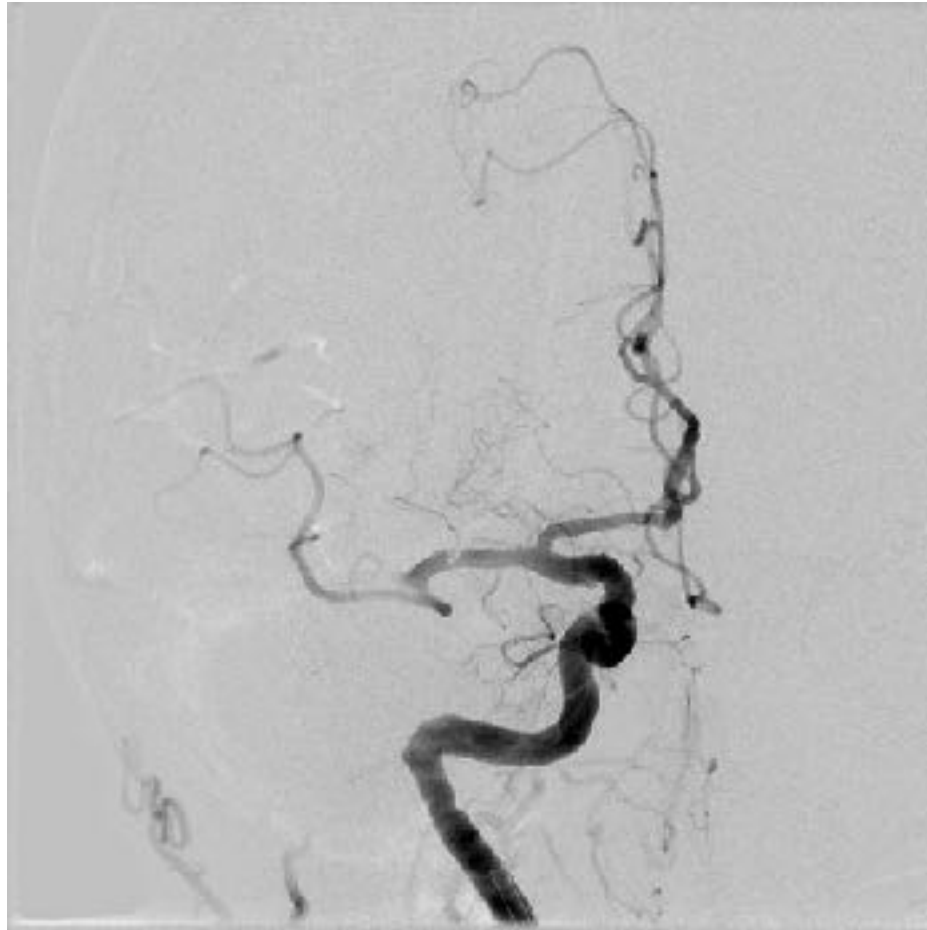
Carotid stenosis

What is wrong?



Aneurysm of middle cerebral artery

What is wrong?



Middle cerebral artery occlusion