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The Assessment of the Intracranial Part of the Internal Carotid Artery

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Summary. The intracranial part of the internal carotid artery was plotted by linear and angular measurements made on 100 normal angiograms both in sagittal, half-axial and lateral projections. After the mean values and standard deviation measurements had been calculated a model was devised to facilitate the evaluation of the shape and position of this artery in pathological conditions.

Caractéristiques de la partie intra-crânienne de l'artère carotide interne

Résumé. La partie intra-crânienne de l'artère carotide interne fut étudiée à l'aide de mensurations linéaires et angulaires sur 100 angiogrammes normaux, tant en projection sagittale que semi-axiale et latérale. Après détermination des valeurs moyennes et des déviations statistiques, l'auteur propose un modèle qui facilite l'évaluation de la forme et de la situation de cette artère dans les cas pathologiques.

Messungen des intracraniellen Abschnittes der A. carotis interna

Zusammenfassung. An 100 normalen Angiogrammen wurden im seitlichen, sagittalen und halbaxialen Strahlengang Messungen des intracraniellen Abschnittes der A. carotis interna durchgeführt. Die Mittelwerte wurden errechnet. Es wird damit möglich, ohne Schwierigkeiten, normale Fälle von pathologischen Verlagerungen zu unterscheiden.

The aim of this paper was to find a model for an objective assessment of the intracranial part of the internal carotid artery (ICA).

This task was divided into two parts, viz.:
a) the determination of the most common shape of the singular segments of the ICA;
b) the determination of the ICA position against the reference system of linear and angular measurements.

The bibliography provides rather spare information concerning the objective assessment of the intracranial part of the ICA. Bull and Shunk (1962) analysed the intracranial segment of the ICA. Udvarhelyi, Langfit and Cox (1963) used linear and angular measurements for determination of the course of the ICA and anterior cerebral artery in the cases of suprasellar tumours.

In this paper the shape of the ICA was analysed on sagittal, half-axial and lateral angiograms. The ICA was divided into five segments, following Fischer. The points separating the segments were determined as C1 — C5. The bifurcation of the ICA was called "B" and the most frontally situated point of the knee of the carotid siphon was described as ApC (apex carotis). 100 angiograms of adult subjects aged 20—64 years were analysed. There were 58 men and 42 women. In the cases which have been analysed neither the clinical findings nor the supplementary examinations showed any evidence of an intracranial expanding process resulting in eventual shifts of the intracranial structures.

Observation over about a 5 years' period was an additional factor eliminating an intracranial tumour.

Cerebral angiography was performed through the direct puncture of the common carotid artery. The film-changer with a constant focus-film distance of 80 cm was used.

The following reference lines were chosen:
a) in the sagittal view — the midline;
b) on the lateral arteriograms — the nasion-opisthocranion (N — O) line.

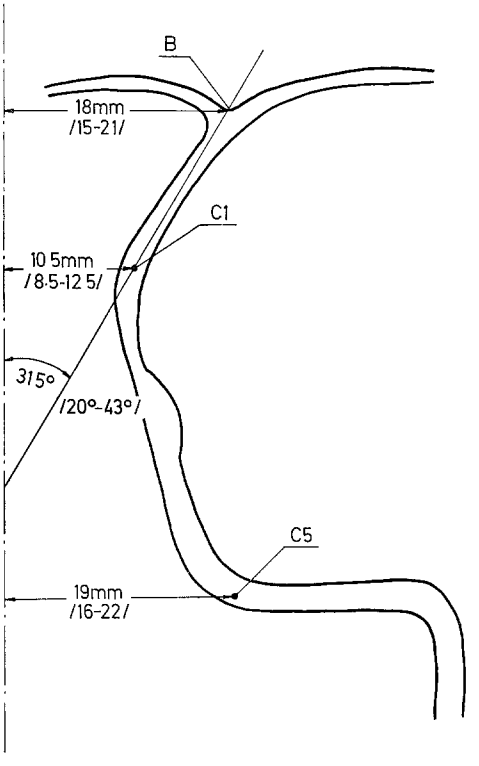

Fig. 1. The measurements in the sagittal, half-axial view. Linear distances of points "B", C 1 and C 5 from the midline. The angle formed by the axis of the segment CI with the midline. Mean values and the range of standard deviation

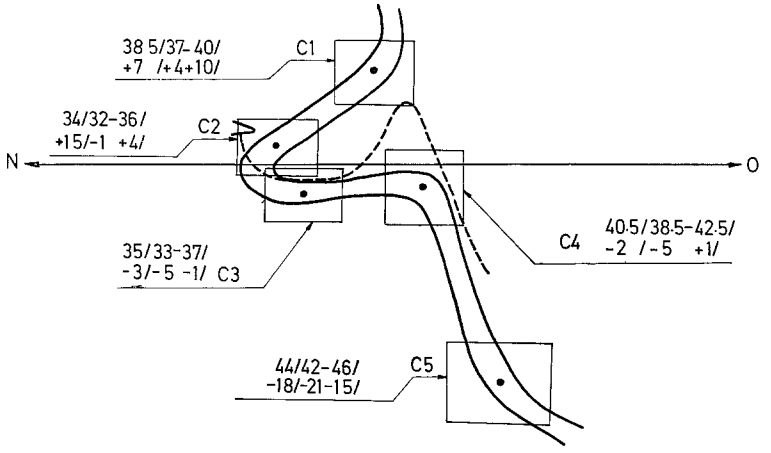

Fig. 2. The position of points C 1 — C 5 in the lateral view referred to the N — O (nasion — opisthocranion) line. The index of the position of these points and the vertical distance is indicated together with the standard deviation

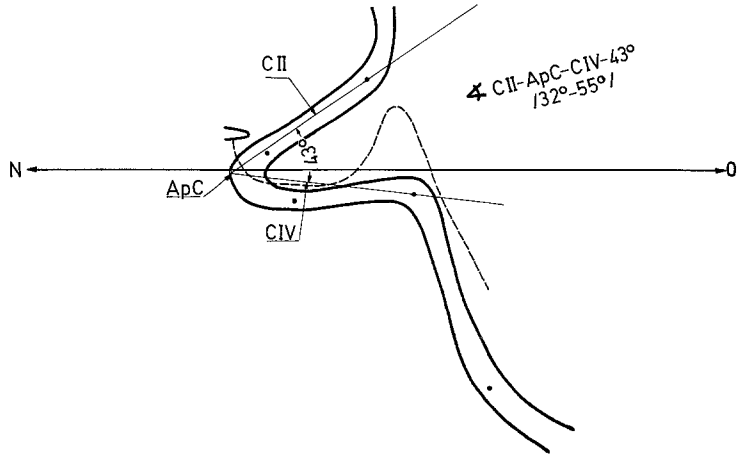

Fig. 3. The angular measurement characterising the relation of segments CII and CIV

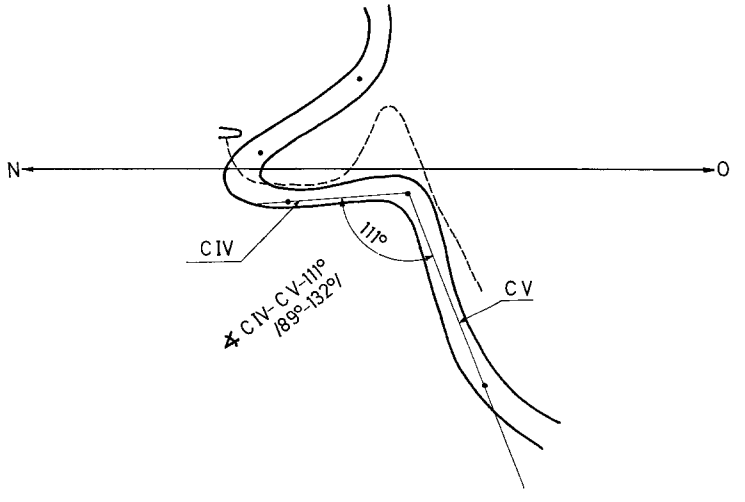

Fig. 4. The angle between the segments CIV — CV

On the sagittal angiograms the following distances were measured:

1. point "B" — midline;
2. point C1 (the beginning of segment CI) — midline;
3. point C5 (the beginning of the segment CV) — midline.

The angle between the axis of the CI segment and the midline was also measured. Fig. 1.

On the lateral angiograms the following measurements were made:

1. An index of the separation of the points between the singular segments of the ICA. To obtain this index the distance between the nasion and the points of the perpendicular projection of the points C1 — C5 on the N — O line was calculated and expressed as a percentage of the length of this line. Fig. 2.

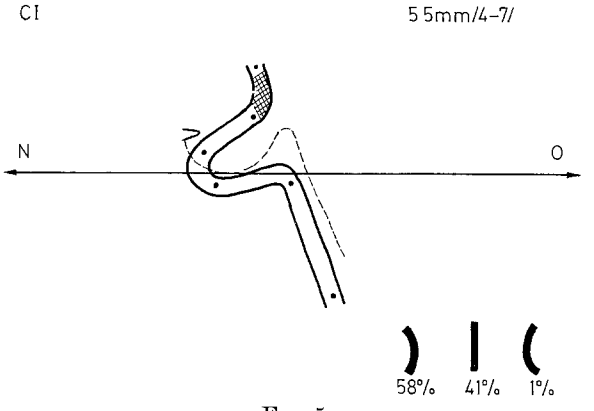

Fig. 5

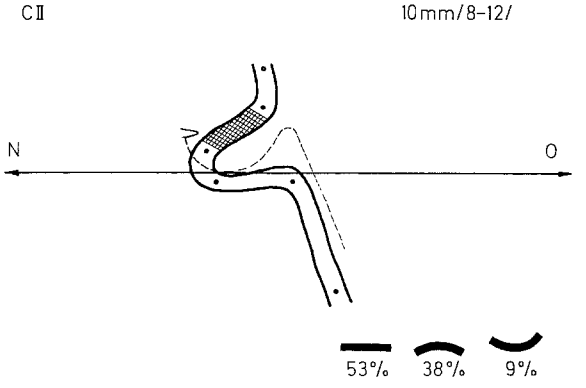

Fig. 6

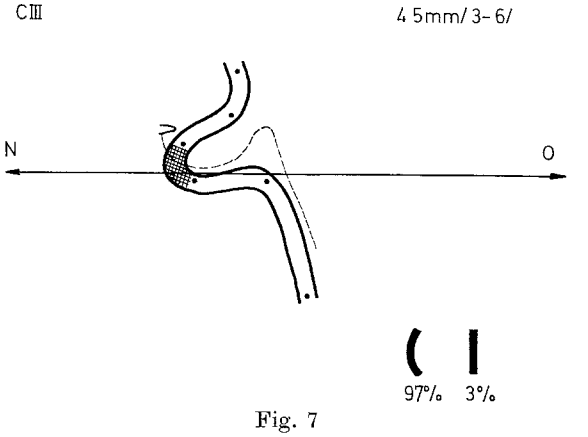

Fig. 7

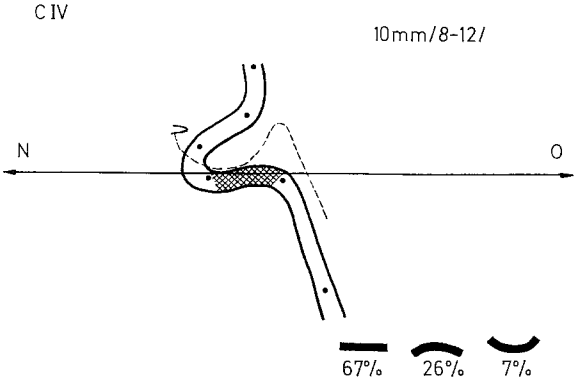

Fig. 8

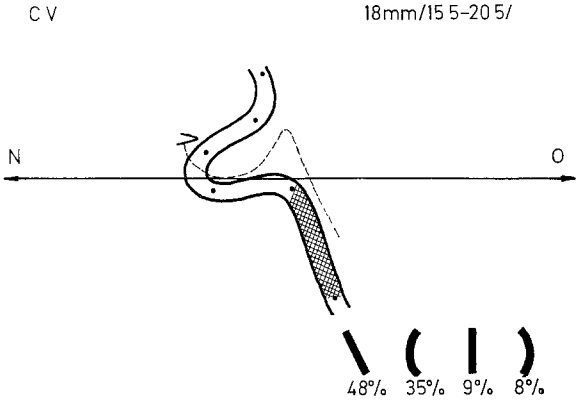

Fig. 9

Fig. 5 to 9. Characteristics of the segments CI — CV. The average length of each segment with range of variation is marked in the right upper corner. The schematic representation of the main types of course of each segment with the percentage of its occurrence is shown

2. The linear measurements of the vertical distances of points C1 — C5 from the N — O line. The positive values correspond to the situation above, the negative values to the position below this line. Fig. 2.
3. The angle formed by the lines joining the points C4 and C1 with the point ApC. Fig. 3.
4. The angle formed by the axes of the segments CV and CIV. Fig. 4.
5. The measurement of the length and the determination of the main types of the shape of singular segments of the ICA. Fig. 5—9.

For each measurement the mean value and standard deviation were calculated. The results are demonstrated on Tables I and II and on the concomitant figures.

Table 1. *Measurements in half-axial A—P view*

	Mean value	Standard deviation
Linear measurements		
Distances:		
Point B — midline	18.19	2.75
Point C1 — midline	10.66	1.97
Point C5 — midline	18.85	3.04
Angular measurement:		
C1 — midline	31.5°	11.28°

On the basis of the mean values determining the position of the singular points mentioned above a schematic model simulating the most common course of the ICA was conceived.

To check up the applicability of these model measurements some more measurements were made in 100 pathological cases including 90 supratentorial tumours and 10 cases of marked hydrocephalus. According to the anatomical properties most changes were found in the measurements characterising the position of the terminal segments of the ICA — CII and CI.

For practical reasons some observations should be mentioned, viz.:

1. On the sagittal angiograms the determination of the angle between the segment CI and the midline seems to be the most useful measurement.
2. The distances of points "B" and C5 from the midline approximately are the same in most cases. As the anatomical situation of point C5 is more stable, it may be considered as the relative reference point for evaluating the position of the bifurcation of the ICA.
3. On the lateral angiograms the position of the ICA may be determined by the index of singular points referred to the N — O line. However, the angular measurements characterising the position of the segments of the ICA to each other seem to be of greater value.

Table 2. *Measurements in lateral view*

	Mean value	Standard deviation
Position of the particular points against the N — O line (index in %):		
C5	44.07	2.22
C4	40.52	1.86
C3	35.31	1.72
C2	34.15	1.68
C1	38.54	1.76
ApC	32.73	1.77
Distances of the particular points from the N — O line (millimeters):		
C5	— 17.95	3.28
C4	— 1.82	2.94
C3	— 2.74	2.32
C2	+ 1.36	2.25
C1	+ 7.22	2.69
C1 upper end	+ 13.22	3.08
ApC	— 0.16	2.33
Angular measurements:		
angle CV — CIV	110.65°	21.75
angle C1 — ApC — C4	43.18°	11.55°

References

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