

Cephalic Vein. Detail of its Anatomy in the Deltopectoral Triangle

Vena Cefálica. Detalle de su Anatomía en el Trígono Deltopectoral

Luis Andrés Yeri; Eduardo Javier Houghton; Bruno Palmieri; María Flores; Marcelo Gergely & Jorge E. Gómez

YERI, L. A.; HOUGHTON, E. J.; PALMIERI, B.; FLORES, M.; GERGELY, M. & GÓMEZ, J. E. Cephalic vein. Detail of its anatomy in the deltopectoral triangle. *Int. J. Morphol.*, 27(4):1037-1042, 2009.

SUMMARY: The cephalic vein shows a scarce description, especially in the deltopectoral triangle, and its ending in the axillary vein. Some established considerations such as “superficial vein, located in the deltopectoral groove, accompanied by branches of the thoraco-acromial artery, which ends in the deltopectoral triangle in the shape of fan arch” should be reevaluated. Procedures difficulties in the catheterization deserve for a more accurate description. A descriptive, prospective study is performed. The goal is to determine the anatomy of the cephalic vein in the deltopectoral triangle, with a special focus on the characteristics concerning its path and type of termination. Findings show that the cephalic vein is deeply placed and has a different path than that of an arch (circumference segment on a level) with a retro pectoral path and an acceptable diameter, thus useful and safe in the catheterization processes.

KEY WORDS: Cephalic vein; Deltopectoral triangle; Clavipectoral triangle; Catheterization; Venous access.

INTRODUCTION

Cephalic vein (CV) is classically described with its origin in the side corner of the dorsal venous network of the hand. From there the vein ascends towards the cubital fossa, where it receives one of the branches corresponding to the median antebrachial vein. In the arm, it is located side with the braquii biceps muscle, arriving finally at the shoulder occupying the deltopectoral groove (DG). On a second level, the pectoralis minor muscle (PmM) and the clavipectoral fascia (CF) are located and, after folding the MPMN; they continue in the direction of the clavicle repeating the action with the muscle subclavius (MSC).

On the level of the deltopectoral triangle, the CV goes through the clavipectoral fascia and connects to the branches of the thoracoacromial artery and joins the axillary vein (AV) (Bouchet & Cuillerette, 1979; Heitzman, 1885; O’Rahilly, 1986; Romanes, 1977; Testut & Jacob, 1982; Wanke *et al.*, 1956; Williams & Warwick, 1992).

Authors such as Chen *et al.* (2005), Grossman & Baim (1992) and Loukas *et al.* (2008) mention difficulties in finding the CV during surgery. These statements lead us to think there are details from an anatomical point of view, which are still to be clarified. Other authors point out the goodness of the CV as

way of access (De Rosa *et al.*, 1998; Le Saout *et al.*, 1983; Langard *et al.*, 1985; Nobili, 1976; Povoski, 2000; Viaggio *et al.*, 1965), as they mention some details of its anatomy.

This study has been made with an aim to describe the CV in the deltopectoral triangle and its termination in the AV, detailing its relationships, diameter, path and percentage of absence. The average diameter of the cephalic vein will be determined, as well as the average distance to the coracoid process (CP) and to the clavicle. The study will also determine the existence or absence of arch, the average length of the retro pectoral path and the existence or absence of satellite artery branches.

Knowledge concerning the above mentioned details would minimize the complications during practice, in the eventual case of use of the CV during surgery.

MATERIAL AND METHOD

The design of this study was prospective and descriptive. Inclusion criteria were: Non dissected shoulder

girdle of adult corpses in formaldehyde pertaining to the Second Course of Anatomy of the Faculty of Medicine of Universidad de Buenos Aires, Argentina.

Fifty shoulders were dissected (27 right and 23 left shoulders) from corpses of adults in formaldehyde to 5%. They were split into two series: 18 first dissections with the pectoralis major muscle (PMM) unreclined and the remaining 32 shoulders with muscle pectoralis major removed and reclined from their clavicular head.

The cutaneous incision was made in a T shape with its branches corresponding to the clavicle and to the lateral edge of the PMM; flaps are reclined to the side and medium, uncovering the area of the deltopectoral triangle. VC diameters were measured on both series, as well as the clavicle and the sides of the triangle.

Concerning the 32 cases where the PMM was reclined to the lower mid end, the length in the retropectoral path was determined in 28 opportunities and the termination of the VC in the VAX was observed. The path of the cephalic vein in relation to the coracoid process was split into a pre-coracoid and a post-coracoid segments.

A blunt dissection of the CV was performed, palpating the CP, measuring the distance to the edge that separates them, measuring also the venous diameter in the lateral edge of the PMM, using a "Caliper Vernier" 125 x 0.02 mm caliber.

The registry of each case was written down on a spreadsheet including the relevant variations, as well as a scheme of all the findings. Dissections were pictured using a 6 mega pixels digital camera. The statistical analysis was performed with XLSTAT 2008.

RESULTS

When reclining the PMM, the CV was found covered by the deep fascia, portraying a false sensation of perforation (Fig. 1). As the fascia is lifted out, it is noticeable how the vein goes along the CF level, until reaching the AV or transits between the axillary and subclavian (Fig. 2).

CV is located in the medium next to the CP (vertex) at an average distance of 7.9 ± 6.0 mm (1SD) with a range from 0 to 20 mm (Table I).

The average diameter of the CV, at the level of its meeting the lateral edge on the PMM was of 3.7 ± 1.30 mm (1SD) and a range of 1.0-7.5 mm (Table II).

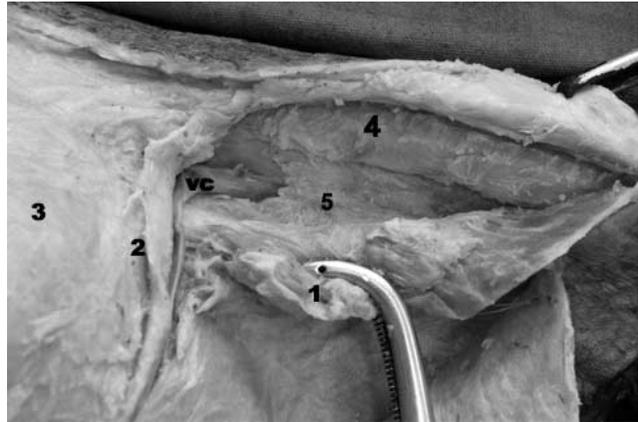


Fig. 1. Vena cephalica; 1. Pectoralis major muscle reclined; 2. Coracoideus processus; 3. Deltoideus muscle; 4. Clavicle; 5. Pectoral deep fascia.

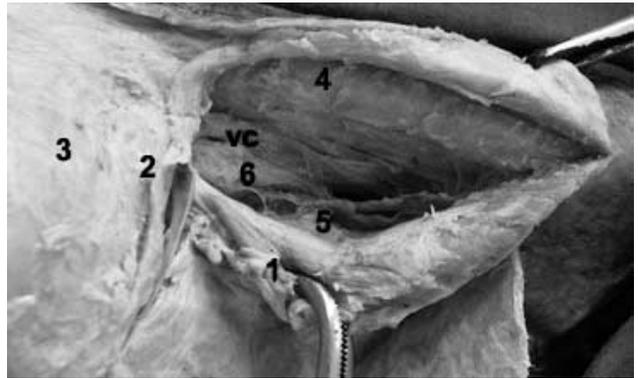


Fig. 2. Vena cephalica; 1. Pectoralis major muscle reclined; 2. Coracoideus processus covered by 3. Deltoideus muscle; 4. Clavicle; 5. Pectoral deep fascia; 6. Clavipectoralis fascia.

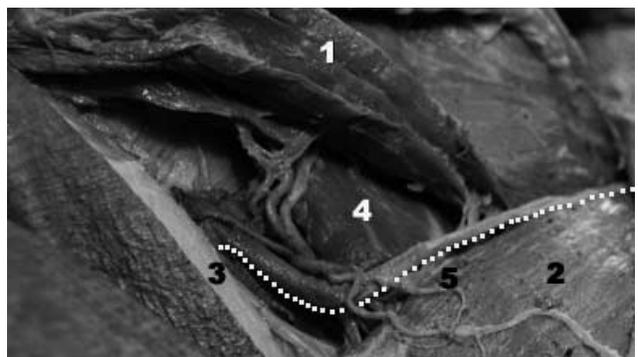


Fig. 3. 1. Pectoralis major muscle; 2. Deltoideus muscle; 3. clavicle; 4. Pectoralis minor muscle; 5. Coracoid process. The dotted line outlines the path of the cephalic vein until its connection with the axillary vein.

Regarding the relationship between the fibers of the deltoid muscle and the PMM, the findings show a fusion with absence of TDP in 4/50 of cases, in the remaining cases the separation at the clavicle level was on average of 19.8 mm, with a range of 0 to 50 mm. The distance from the VC

Table I. Distance from cephalic vein to process coracoid in milimeters. Medium reliable interval at 95% (6.0-9.7).

Lower limit	Upper limit	Frequency	Relative frequency
0,0	2,1	11	0,24
2,1	4,2	3	0,07
4,2	6,3	6	0,13
6,3	8,4	5	0,11
8,4	10,5	5	0,11
10,5	12,6	3	0,07
12,6	14,7	2	0,04
14,7	16,8	7	0,16
16,8	18,9	1	0,02
18,9	21	2	0,04
Minimum	Maximum	Medium	Typical deviation
0,0	20,0	7,9	6,0

Medium reliable interval at 95% (6,0-9,7)

Table II. Diameters of the cephalic vein in millimeters. Medium reliable interval at 95%: (3.34-4.12).

Lower limits	Upper limits	Frequency	Relative frequency
1,0	1,7	1	0,02
1,7	2,3	5	0,11
2,3	3,0	6	0,13
3,0	3,6	11	0,24
3,6	4,3	6	0,13
4,3	5,0	8	0,18
5,0	5,6	6	0,13
5,6	6,3	1	0,02
6,3	6,9	0	0,00
6,9	7,6	1	0,02

Medium reliable interval at 95%: (3,34-4,12)

Table III. Distance from the cephalic vein to the clavicle, in milimeters. Medium reliable interval at 95%: (7.54-12.60).

Lower limit	Upper limit	Frequency	Relative frequency
0,00	4,06	11	0,24
4,06	8,12	14	0,31
8,12	12,18	6	0,13
12,18	16,24	6	0,13
16,24	20,3	3	0,07
20,3	24,36	2	0,04
24,36	28,42	1	0,02
28,42	32,48	1	0,02
32,48	36,54	0	0,00
36,54	40,60	1	0,02
Minimum	Maximum	Medium	Typical deviation
0,0	39,60	10,1	8,4

Medium reliable interval at 95%:(7,54-12,60)

Table IV. Length of deltopectoral triangle in millimeters. Medium reliable interval at 95%: (16.95-23.78).

Lower limits	Upper limits	Frequency	Relative frequency
0,0	4,1	0	0,00
4,1	8,2	3	0,11
8,2	12,3	4	0,15
12,3	16,4	2	0,07
16,4	20,5	4	0,15
20,5	24,6	5	0,19
24,6	28,7	6	0,22
28,7	32,8	2	0,07
32,8	36,9	0	0,00
36,9	41,0	1	0,04
Minimum	Maximum	Medium	Typical deviation
7,0	40,0	20,4	8,6

Medium reliable interval at 95%:(16,95-23,78)

to the clavicle, at the level of the lateral edge in the PMM showed an average result of 10.1 ± 8.4 mm; range 0 a 39.6 mm (Table III).

The pre-coracoid segment in the CV can be absent in 4/50 of the cases. The post-coracoideous segment of the CV was found in all cases with curves on different levels, with angle variations from slight to deep curves. The first curve is found towards the clavicle on a parasagittal level, describing an anteroposterior path. The CV then goes along in a medium position and almost parallel to the clavicle on an axial level. If finally moves back to an anteroposterior position on an axial level and goes through the CF (Fig. 3).

This segment showed the arch form only (segment of circumference on a level) en 3/32 (12%) of the cases. The final segment shows a retropectoral path with an average measure of 20.4 ± 8.6 mm (1SD), and a range from 7 to 40 mm (Table IV). This same segment showed in its beginning it constantly received 2 to 3 venous branches coming from the deltoid and clavicle sector. We have not found the supra-clavicular variation but in 1/32 (3.6%) of the cases, a cephalic vein attached to the lower side of the clavicle that joined the external jugular vein, and it was separated from the axillary vein by the subclavius muscle.

DISCUSSION

The CV can not be considered to have a superficial condition in the deltopectoral triangle as it is located in a

real muscle aponeurotical conduct, with its limits in the PMM and deltoideus muscle (DM) edges, covered by the superficial deltopectoral fascia, which can be, depending on the case, well conformed in some cases or else it can be slim or even interrupted by segments of fat tissue, resembling the situation of being placed in the subcutaneous celular.

This detail states an important difference with other authors such as Loukas *et al.*, who states that the CV is deep in 20% of the cases. Our dissections show that the CV is always deep, agreeing with Viaggio *et al.* and Nobili.

This may provide explanation to the failures in surgery, where the CV is searched for in the superficial levels as stated by Grossman & Baim, Povoski and Chen *et al.*

The CV does not show other satellite arteries during its path, as classically describes some authors (Testut & Jacob; O'Rahilly; Bouchet & Cuilleret; Williams & Warwick) it can be occasionally crossed by a slim branch, but the main trunk is situated deep in the middle, separated by a conjunctive tissue, as described by Langard *et al.* It has been observed that there is a slim lymphatic vessel accompanying the CV. CV shows a retropectoral path on its way over the CF, which separates it from the PMM, and in none of the cases did we find it finish in the uncovered area of the trigonum deltopectoral, but in the axillary-subclavia transition, at the level of the lower edge of the subclavius muscle.

The post-coracoideous path shows curves somewhat deep on the sagittal and horizontal levels and the presence of fan arch was found in 3 /32 cases.

As to the diameter of the CV (Loukas *et al.*), has the average result of 8 ± 1 mm with a range of 1 to 12 mm; Le Saout *et al.* has values of 3,4 mm. In our research we found an average diameter of 3.7 ± 1.29 mm (1SD) and a range of 1-7.5 mm, the difference between the first and the second values may be due to a 5% retraction for formaldehyde.

As to the absence of the CV, Loukas *et al.* report 5%; Le Saout *et al.* reports 19.7% and De Rosa *et al.* report 5.3%. In our researched dissections we found an absence of 8.2% (4/50). It is important to point out that the absence in our series has in all cases been that of the pre-coracoid segment of the vein. The post-coracoid segment has been found in 100% of our dissections, as a trunk draining the deltoid and clavicular branches.

We have found on one single case that the CV arrives in the external jugular vein; this is to be kept into account

when catheterizing in order to arrive at the cardiac cavities, as the catheter could accidentally slide towards proximal via the external jugular.

In 1/50 (2%) of the cases the cephalic vein was found close to the MD fibers and out of the "deltopectoral duct" y even in those cases the CV was found covered by the muscle aponeurosis. This fact is also mentioned by Langard *et al.* who found it on an 8% of the cases. Knowledge of the above mentioned details may help diminish the inconveniences when using the CV, as it is a good alternative in accessing veins.

ACKNOWLEDGEMENTS

We wish to thank Dr. Gustavo Otegui for his constant stimulus and his unconditional support.

YERI, L. A.; HOUGHTON, E. J.; PALMIERI, B.; FLORES, M.; GERGELY, M. & GÓMEZ, J. E. Vena cefálica. Detalle de su anatomía en el triángulo deltopectoral. *Int. J. Morphol.*, 27(4):1037-1042, 2009.

RESUMEN: La vena cefálica ha sido poco descrita en el triángulo deltopectoral y su terminación en la vena axilar. Algunas consideraciones la señalan como "la vena superficial, situada en el surco deltopectoral, acompañada de ramas de la arteria toraco-acromial, que termina en el triángulo deltopectoral en forma de arco de ventilador" por lo que debe ser reevaluado. Debido a las dificultades en los procedimientos de cateterización la vena cefálica merece una descripción más exacta. Se realizó un estudio descriptivo prospectivo con el objetivo de determinar la anatomía de la vena cefálica en el triángulo deltopectoral, dando especial atención a sus trayecto y tipo de terminación. Los resultados demostraron que la vena cefálica está localizada profundamente en el surco deltopectoral, presenta un trayecto distinto a un arco (segmento de la circunferencia de un nivel) siendo este trayecto retropectoral y un diámetro aceptable, por lo tanto, útil y seguro para los procesos de cateterización.

PALABRAS CLAVE: Vena cefálica; Triángulo deltopectoral; Triángulo clavipectoral; Cateterización; Acceso venoso.

REFERENCES

- Bouchet, A. & Cuilleret, J. *Anatomía descriptiva, topográfica y funcional. Miembro superior*. Buenos Aires, Médica Panamericana, 1979.
- Chen, J. Y.; Chang, K. C.; Lin, Y. C. & Hung, J. S. Pre-procedure duplex ultrasonography to assist cephalic vein isolation in pacemaker and defibrillator implantation. *J. Interv. Card. Electrophysiol.*, 12(1):75-81, 2005.
- De Rosa, F.; Talarico, A.; Mancuso, P. & Plastina, F. New introducer technique for implanting pacemakers and defibrillator leads: Percutaneous incannulation of the cephalic vein. *G. Ital. Cardiol.*, 28(10):1094-8, 1998.
- Grossman, W. & Baim, D. S. *Cateterismo, angiografía e intervencionismo cardíaco*. 4ª. Ed. Buenos Aires, Ed. Inter-Médica, 1992.
- Heitzman, C. *Die Descriptive un topographische anatomie des menschen*. Wilhelm Braumüller, IV:245, 1885.
- Langard, R.; Vogt, O. E.; Hono, A. I. & Arterga, C. R. *La vena cefálica, sus modos de terminación y variedades en el surco delto-pectoral*. XXII Congreso Argentino de Anatomía, UNLP, 1985.
- Le Saout, J.; Vallee, B.; Person, H.; Doutriaux, M.; Blanc, J. & Nguyen, H. Anatomical basis for the surgical use of the cephalic vein (V. cephalica). 74 anatomical dissections. 189 surgical dissections. *J. Chir. (Paris)*, 120(2):131-4, 1983.
- Loukas, M.; Myers, C. S.; Wartmann, Ch. T.; Tubbs, R. S.; Judge, T.; Curry, B. & Jordan, R. The clinical anatomy of the cephalic vein in the deltopectoral triangle. *Folia*

Morphol. (Warsz), 67(1):72-7, 2008.

Nobili, O. I. Actualización de la investigación de la vena cefálica en el surco delto-pectoral. *La Semana Médica*, Año LXXXIII, 149(16):536-7, 1976.

O'Rahilly, R. *Anatomía de Gardner*. 5ª ed. Buenos Aires, Editorial Inter-Americana, 1986.

Povoski, S. P. A prospective analysis of the cephalic vein cutdown approach for chronic indwelling central venous acces in 100 consecutive cancer patients. *Ann. Surg. Oncol.*, 7(7):496-502, 2000.

Romanes, G. J. *Cunningham. Manual de Anatomía*. Madrid, McGraw-Hill Interamericana, 1977.

Testut, L. & Jacob, O. *Tratado de anatomía topográfica, con aplicación médico-quirúrgica*. 8ª ed. Barcelona, Salvat Editores, 1982.

Viaggio, J. L.; Chikiar, A. & Kurtzbart, R. Canalización en el hombro. *Anales Arg. de Medicina*, XI(2):12, 1965.

Wanke, R.; Junge, H. & Eufinger, H. *Cirugía de los grandes vasos*. Buenos Aires, Ed. Beta, 1956.

Williams, P. L. & Warwick, R. *Gray Anatomía*. Madrid, Churchill Livingstone, 1992.

Correspondence to:

Luis Andrés Yeri
Laboratory of Vascular Anatomy
Faculty of Medicine
University of Buenos Aires
E. Zeballos 3638. Torre 2; piso 5; depto. 4
C.P.: 1872, Sarandí
Buenos Aires
ARGENTINA

Email: andresyer@yahoo.com.ar

Received: 04-01-2009

Accepted: 05-11-2009