

Radial Artery Access: Should it Be Used More Often?

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From the time it was first described by Campeau in 1989,¹ performing angiography using the transradial approach has undergone great advancement; thus, Kiemeneij et al² in 1995 published the first description of coronary interventionism using this approach. At the present time, in a remarkable number of hemodynamic laboratories, it is the principal approach both for coronary angiography and for patients undergoing cardiac intervention. Nevertheless, and in spite of the advantages that have been demonstrated in some aspects when using the transradial approach, the femoral approach continues to be used more often, probably due to certain limitations of the radial approach.

ADVANTAGES OF THE RADIAL APPROACH

The radial artery, in contrast to the brachial and femoral arteries, has a superficial route, passes over the bony structure of the radius, and there are no important venous structures or nerves in its immediate vicinity. All this eases and simplifies compression of the artery and monitoring of possible hematomas or hemorrhages and decreases possible complications such as neuropathy or A-V fistulas, and even the possible embolization of cholesterol crystals in patients with severe arteriosclerosis of the aorta. Similarly, the transradial approach allows for an earlier ability to ambulate, resulting in earlier patient discharge and a more comfortable post-catheterization period. Many studies have shown that using the radial approach means, with respect to the femoral and brachial approach, a significant decrease in vascular complications at the puncture site³ in high-risk cases such as patients who undergo intensive anticoagulant, antithrombotic, or antiaggregant plaque therapy, obese patients; patients with hypertension; or patients with a full pulse wave.

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Nevertheless, when vascular complications are compared, occlusion of the radial artery is not mentioned, although it has a relatively high incidence rate (3% to 5%), since it does not have significant repercussions when the palmar arch is permeable. The use of this means of access can decrease the cost of the procedure by reducing the length of hospital stay,⁴ as it allows for early patient discharge on the same day the angiographic study is performed. Nevertheless, in many medical centers, particularly in the United States, the majority of diagnostic ambulatory coronary angiography procedures are performed via femoral access with excellent results. The use of the radial artery, facilitated by advances in intervention materials, has been progressively and successfully extended to more complex techniques and cases: stent implantation,⁵ arterectomy, and primary angioplasty, with an overall procedural success rate in the series of more than 95%, although the intervention cardiologists involved in the study had a great deal of experience in using this method of access.

LIMITATIONS OF THE RADIAL APPROACH

The radial artery, although it has a certain expansion capacity, is significantly smaller than the femoral and brachial arteries, with an average lumen diameter of less than 3 mm. This limits its use to catheters of a smaller diameter, especially in patients with low body surface, and increases the possibility of artery spasm, significantly increasing the local discomfort of patients during the procedure. This discomfort is decreased by the use of hydrophilic material that has been specifically developed for the radial approach, although it continues to be a problem that needs to be solved. Given the greater incidence of occlusion, the radial approach is contraindicated in patients with palmar arch instability. Permeability is usually studied by use of an Allen test, which is abnormal in 10% to 15% of patients. Similarly, the re-use of this approach is clearly more limited than it is in other means of access.

The radial approach is technically more difficult and demanding. On one hand, the tendency toward spasm of this artery, the subclavian-aorta curves, and anatomo-

mical variations make advancing and handling of the catheters difficult. On the other hand, it is more difficult to cannulate the coronary arteries and achieve adequate catheter support, especially when interventions are being performed. For this reason, including in the most expert hands, the length of the procedure and irradiation is greater than when the femoral approach is used. Although limited, failure of this technique (5% to 7% of cases) occurs, above all in patients of advanced age, female patients, and patients with a low body mass index, primarily due to difficulty in puncturing the artery and, to a lesser degree, to anatomical variations or spasm—which make advancement of the catheter impossible—and to inadequate cannulation of the coronary arteries.

All these technical difficulties are reflected in the demanding learning curve needed to master the radial approach, and the need to decrease the incidence of failure and shorten the time required for the procedure. In this issue of the *REVISTA ESPAÑOLA DE CARDIOLOGÍA*, 2 articles have been published that document the experience of 2 Spanish groups with the radial approach. In 1 of them, Salgado et al⁶ studied 526 consecutive patients in whom the radial approach was attempted. In order to evaluate the learning curve, they compared the first 200 cases with the cases performed thereafter. Their results concur with those of other published studies; they observed that increased experience led to an increase in the success rate of the technique (91% of cases vs 95.4%; $P=.04$), a decrease in the time needed for the procedure (23 minutes vs 19 minutes; $P<.001$), and a decrease in time needed for fluoroscopy (6.4 minutes vs 5 minutes; $P<.001$). Reasons for failure of the technique were the same as those already mentioned, and the complications were all less (hematomas or slight hemorrhages), with an occlusion rate of the radial artery of 2.8% during the first 24 hours. Angioplasty via the radial approach was attempted in 169 of these patients, with a success rate of 96.1%. These results were compared with the data from a group of patients in whom the femoral approach was used, either for diagnostic studies or interventions. In the femoral access group the success rate for diagnostic procedures was greater (100% of cases vs 93.7%) than the success rate for the radial approach, with a shorter procedure time (16 minutes vs 19 minutes; $P<.001$) and shorter fluoroscopy time (3 minutes vs 5 minutes; $P<.001$), but with a 0.6% rate of major vascular complications ($P=.081$). Nevertheless, these groups are difficult to compare, as the femoral access group was studied by means of retrospective analysis, without taking into account the reasons for which the cardiologist chose one approach or another, and although there was no difference between the 2 groups with regard to the principal clinical variables, it was found that the femoral approach group had a tendency to include a greater percentage of diabetics, women,

and patients with hypercholesterolemia, without analyzing the role of body mass index. Actually, the radial artery is shown to be an approach whose principal advantages are patient comfort after the procedure and a decrease in local vascular complications, with the limitation of a significant learning curve and technical demands which prolong the procedure. Finally, the authors used the femoral approach as the first option in patients undergoing primary angioplasty, choosing speed over the risk of vascular complications in accessing the occluded coronary artery in one subgroup, at least, at high risk for this type of complications.

In the article on the subject published in this issue, Sanmartín et al⁷ analyzed the results obtained from patients in whom diagnostic coronary angiography was performed via the radial approach with 4F catheters, about which there is little information in the literature. This combination, which attempts to reduce the invasiveness of the test, led the authors to include the term «minimally invasive catheterization» in the title. The reduction in the caliber of hemodynamic catheters has been a constant in recent years, and has been made possible by an improvement in the material (greater internal caliber while maintaining the capacity for manipulating the catheter) and fundamentally aims to decrease local vascular complications.⁸ Nevertheless, the smaller the caliber of the catheter, the worse the opacification of the artery will be, and the more limited the type and size of the devices that can be used and the more difficult their manipulation will be, and they will also provide less support. The authors attempt to show that coronary angiography can be successfully performed via the radial approach with small diameter catheters such as the 4F type, and with sufficient dependability and image quality. To this end, the authors analyzed the results from 206 coronary angiographies performed over a period of 12 months and found that the success rate was greater than 95%, with a minimal incidence of complications, confirming that this is a feasible procedure. In order to evaluate image quality, the authors established a 3-grade qualitative evaluation (bad, average, and optimal), and in 18 cases of recent coronary angiography with 6F catheters, they compared they compared the diameters involved in the 2 coronary angiographies. The image was considered optimal in 83% of cases (left coronary artery), with a good correlation with the diameter involved ($r=0.92$; $P<.01$). Nevertheless, and as the authors themselves state, the evaluation of the image was too simplistic and the comparison of the diameters involved had clear methodological limitations (low number of cases, different projections, use of NTG). From the practical point of view, the use of 4F catheters is justified when it is necessary to decrease vascular complications, maintaining sufficient quality of the image obtained. The first variable is more evident in the femoral approach, as with the radial approach there are few com-

plications and it is difficult to reduce the incidence of complications. In fact, in this study, the occlusion rate of the radial approach was similar to that described in the literature (3%), and therefore its use is more justified in patients with smaller radial arteries (patients with low body mass index, women) who have been partially excluded from this study. With smaller diameter catheters it would be possible to reduce local patient discomfort during catheter manipulation, although this aspect was studied in this case. On the other hand, and in spite of the methodological limitations, image quality would probably not be better than that obtained with catheters of a larger diameter (5F to 6F). Today, in the majority of hemodynamic laboratories, coronary intervention is frequently performed immediately after diagnostic studies; therefore, using 4F catheters would later require changing to larger diameter catheters and the possible initial advantage would be lost. In this study, and in spite of the fact that the patients were selected (28.6% with coronary arteries without lesions), this occurred in 43 cases (21%).

In our hospital, the use of the radial approach is basically limited to patients in whom the femoral approach would be very difficult or impossible. Undoubtedly, the opinion an individual has about a particular technique is clearly influenced by the experience one has with the technique and by one's personal interest in its development.^{9,10} It could be asked: should we use this approach more? To answer this question various variables must be considered. First, the response would depend on the characteristics of the medical center where the procedures are performed—if it is a hospital where many outpatient procedures are performed, or when the patient is to be discharged the same day the angioplasty is performed, the radial approach may have certain advantages. If, on the other hand, it is a referral center with complex patients who, on occasion, undergo procedures during which an intervention must be performed, the patients are admitted for at least 24 hours following the procedure, and devices that require a larger internal lumen will be used more frequently, the femoral approach seem to be a better choice. Second, it would depend on the preferences of both the physician and the patient. There are interventional cardiologists who feel more comfortable with one technique in particular and by using it more frequently they acquire greater experience, which ultimately is what will influence the results and possible complications. Undoubtedly, as is demonstrated by the development historically of interventional cardiology, the ease and speed of using a particular technique or device is one of the characteristics that most influences its use, and in this manner the femoral approach is superior to the radial approach. On the other hand, as has happened on occasion, there may be patients who have a personal preference for one technique over another after having had experien-

ce with both, which may affect the physician's choice. Restricting the choice of the radial approach, usually more technically complex, to patients in whom it is not possible to use the femoral approach carries the risk of using the technique in a low number of patients, so that the experience acquired by using it may be insufficient. Finally, including in medical centers where the femoral approach is usually used, there are some types of patients who, although there is no contraindication for the femoral approach, have characteristics that would make the use of the radial approach desirable: significant obesity; known peripheral vascular problems in the lower limbs; vascular complications during previous catheterizations via the femoral approach; difficulty in remaining supine for a long period of time; or other reasons, although it should not be forgotten that many of these patients are also more technically complex cases in terms of using the radial approach. Actually, both in the articles mentioned and in other published studies, it has been shown that the radial approach, in spite of its limitations, has certain advantages, particularly in specific subgroups of patients, which requires that interventional cardiologists know how to use this technique so that it can be applied, in large or small measure, depending on the characteristics of their patients and of the medical center where they practice. Similarly, in the hemodynamic laboratory it is necessary to be familiar with more than one approach, and in this regard the radial approach seems to have replaced the brachial approach as an alternative to the femoral artery approach.¹¹

ACKNOWLEDGEMENTS

I would like to thank Drs. Javier Botas and Javier Soriano for their critical review of the manuscript.

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