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Diagnostic and Interventional Coronary Procedures by the Distal Radial Artery in the Anatomical SnuffBox: A Real World Analysis

Joao Felipe Barros de Toledo[1,3,5,6,7], **Luiz Antonio Gubolino**[1,2,3,4,5,6,7], **Pablo Tome Teixeirense**[1,3,5,6,7], **Antoninha Marta LA Bragalha**[1] **and Idiberto Jose Zotarelli Filho**[8*]

[1]*The Heart Institute Hospital cane suppliers of Piracicaba (INCORPI), Piracicaba, SP, Brazil*

[2]*Incor Rio Preto-Hospital Beneficence Portuguese, Sao Jose do Rio Preto, SP, Brazil*

[3]*Hospital Santa Casa De Misericordia, Limeira, SP, Brazil*

[4]*Austacor-Hospital Austa, Sao Jose do Rio Preto, SP, Brazil*

[5]*Hospital Unimed, Americana, SP, Brazil*

[6]*Hospital Mother Theodora, Campinas, SP, Brazil*

[7]*Hospital San Rafael, Santa Casa, Rio Claro, SP, Brazil*

[8]*Unipos-Department of scientific production, Sao Jose does Rio Preto SP, Brazil*

[*]**Corresponding author:** Idiberto Jose Zotarelli Filho, Unipos-Department of scientific production, Sao Jose do Rio Preto SP, 15020-040, Brazil, Tel: +55(17) 98166-6537; E-mail: scientificresearch@unipos.com.br

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Abstract

Background: The Distal transradial access for coronary procedures has been recently demonstrated as an alternative technique. We tried to show that it can be easily reproduced.

Methods: 151 cases from seven different institutions, made by three operators experienced with conventional radial access. Clinical and procedural data were recorded for each patient. Intra-hospital ischemic and bleeding complications were monitored.

Results: Puncture was attempted successfully in 142 cases (94%), 114 (80.3%) diagnostic and 28 (19.7%) coronary interventional procedures. Mean procedure time was 11.1 ± 9.65 minute and mean fluoroscopy time was 5.3 ± 5.93 minute. There were no ischemic complications and only one mild bleeding (0.7%).

Conclusion: Distal trans-radial access for diagnostic catheterization and percutaneous coronary intervention is a reproducible and safe technique.

Keywords: Radial artery; Catheterization; Percutaneous coronary intervention

Introduction

The use of the radial artery as the access route for diagnostic procedures in cardiology had its first description in literature made by Lucien Campeau in 1989 [1]. Sometime later, Kiemeneij published article [2] with the first three patients submitted to angioplasty with stent implantation by this route. In 1997, the same author published the study ACCESS [3], comparing the coronary intervention from the radial, brachial and femoral accesses. The significant reduction in local hemorrhagic complications associated with TRA access (0% *versus* 2.3% *versus* 2.0%, respectively, p=0.035) will give a global boost in preference for this elegant access route, including some pioneering Brazilian centres in the technique [4]. This safety profile will also be demonstrated in patients with acute coronary syndromes [5] and, in parallel, there will be evidence of a strong correlation between major haemorrhagic events related to vascular access, femoral artery utilization, and increased mortality [6-8].

The preference for TRA access gains solidity with studies that show a positive association between such a pathway and the reduction of cardiac mortality, mediated by a lower rate of vascular complications, including in patients undergoing primary and salvage angioplasty [9-11]. New publications undress interesting and less remembered aspects of technique. Retrospective analysis of the British Columbia Cardiac and Renal Registries database revealed that the progression to chronic renal failure after six months of cardiac catheterization occurred in 0.2% of those who underwent the ART procedure *versus* 1.2% transfemoral (p<0.0001). Another meta-analysis [13] evidenced that despite a greater manipulation through vessels such as Brachiocephalic Trunk, when we accessed the heart from the radial artery, the occurrence of vascular accidents and neurological sequelae was equal in both groups.

In 2017, Kiemeneij sharpens the scientific curiosity of our community with the publication of a series [14] of 70 patients in which diagnostic catheterization or coronary intervention were performed by the left distal transradial (ldTRA) puncture in the anatomical snuff box. Although there were 8 puncture failures (11.4%), the remaining 62 patients did not impose major difficulties nor did they report significant discomfort during the examination. A new season of questioning and hypothesis formulation opens on the new site of access to an already well-studied artery in interventional cardiology.

Therefore, the present study analysed the reproducibility of the distal transradial (dTRA) puncture method in the anatomical, regardless of the chosen laterality, in different hospitals and with different operators, in diagnostic procedures or therapeutic interventions in the coronary territory.

Materials and Methods

Study design

It is a prospective longitudinal study of a consecutive series of patients undergoing cardiac catheterization or coronary angioplasty *via* distal transradial (dTRA) (Figure 1). Of the 151 patients, puncture failed in 9 (5.9%), requiring traditional TRA puncture or brachial puncture. Therefore, 142 patients were effectively included for analysis, of which 114 (80.3%) underwent diagnostic procedures and 28 (19.7%) underwent coronary angioplasty. The procedures were carried out in seven different institutions, by the hands of three distinct operators, during 3 months. The project was approved by the local Institutional Ethics Committee and the patients signed the Informed Consent Term.

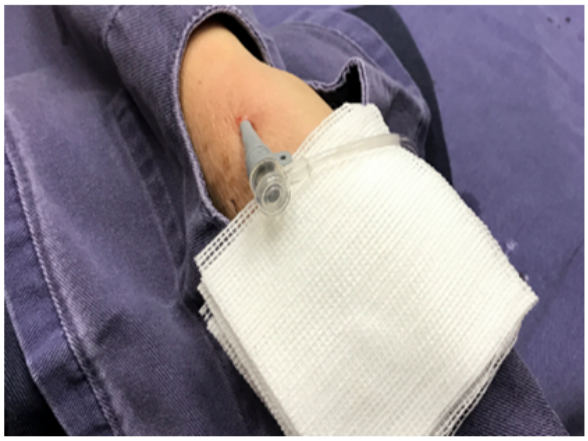

Figure 1: Access road was obtained by the right upper limb.

The data of each patient and procedure were collected at the end of the examination and stored in a spreadsheet for later analysis. The time of the procedure was timed by a professional of the nursing team or radiology, from the administration of the local anesthetic to the withdrawal of the catheter. Puncture time was determined from local anesthesia until cannulation of the vessel. The fluoroscopy time was obtained electronically from the "software's" of each hemodynamic device. In spite of the specific differences with respect to dTRA puncture, the materials and protocols used followed the conventional standard of each institution for the usual radial technique.

In the same way, we maintained routine guidelines regarding the time of haemostasis and hospital discharge, both for outpatient and inpatient procedures. When performing coronary angioplasty, the double platelet antiplatelet and the use of heparin did not undergo any adjustments because it was a different technique. When the access route was obtained by the left upper limb, the puncture was performed on both the left side of the patient, similar to the conventional radial puncture, and the right side of the patient, with the left hand positioned towards the right groin, allowing the operator puncture and work more ergonomically (Figure 2).

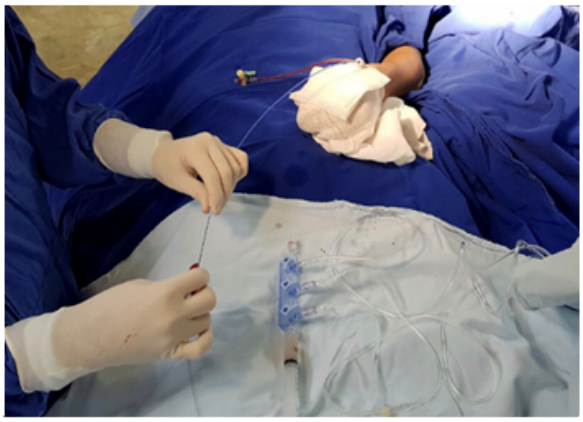

Figure 2: Cardiac catheterization or coronary angioplasty *via* TRad.

At the end of the procedure, haemostasis was applied through a compressive dressing with a small gauze plug (Figure 3). After 30 minutes, the dressing was replaced by a semi-compressive and at the time of discharge, the presence of the radial pulse was checked, as well as the appropriate perfusion of the hand.

Figure 3: Compressive dressing with a small gauze cap.

Sources of information

The review protocol was based on the criteria of literary search with the use of mesh terms in the main databases such as Pubmed, Medline, Bireme, EBSCO, Scielo, etc. All references are registered in endnote by the site:

http://www.myendnoteweb.com/EndNoteWeb.html?cat=myrefs&

Search strategy

In general, as an example, the search strategy in MEDLINE/ Pubmed, Web of Science, ScienceDirect Journals (Elsevier), Scopus (Elsevier), OneFile (Gale) followed the following steps: - search for mesh terms (Radial artery, Catheterization, Percutaneous coronary intervention) - use of the bouleanos "and" between mesh terms and "or" among the historical findings.

Results

Between October 3, 2017 and January 2, 2018, 151 patients were selected to undergo catheterization or coronary angioplasty *via* dTRA. The selection was made at the discretion of the operator, whenever there was a palpable pulse in the region of the anatomical snuffbox. Of the 151 patients, puncture failed in 9 (5.9%), requiring traditional TRA puncture or brachial puncture. Therefore, 142 patients were effectively included for analysis, of which 114 (80.3%) underwent diagnostic procedures and 28 (19.7%) underwent coronary angioplasty. The essential demographics and characteristics related to the clinical presentation of the patients are listed in Table 1.

Technical data regarding the procedure are listed in Table 2. No complications or discomfort were reported to patients during the procedure. In only 1 patient (0.7%), a discrete hematoma was found around the puncture site immediately after a diagnostic catheterization, and no additional clinical care was required.

Variables	n=142
Age (years)	63 ± 9.45
Male, n (%)	101 (71)
Weight, kg	80.1 ± 14.46
Height, cm	168.4 ± 8.01
BMI	28.2 ± 7.28
Stable Angina, n (%)	75 (52.8)
Unstable Angina, n (%)	55 (38.7)
AMI com ST, n (%)	12 (8.5)
BMI: Body Mass Index; AMI: Acute Myocardial Infarction; ST: Segment Elevation	

Table 1: Clinical demographics.

Variables	n=142
Right dTRA, n (%)	124 (87.3%)
Left dTRA, n (%)	18 (12.7%)
Introducer 5 French, n (%)	131 (92.3%)
Introducer 6 French, n (%)	11 (7.7%)
Procedure time, min	11.1 ± 9.65
Time of puncture, min	2.25 ± 0.35
Fluoroscopy time, min	5.3 ± 5.93
Contrast Volume, ml	83 ± 32.94
Haemorrhagic complications, n (%)	1 (0.7%)
dTRA: Distal Transradial	

Table 2: Characteristics of the procedure.

There was no loss of the radial pulse immediately after the procedure nor a decrease in the degree of perfusion of the hand. Table 3 divides the sample between diagnostic procedures and coronary angioplasty, evidencing the differences in time recorded and volume of contrast used.

Variables	Catheterism (n=114)	Angioplasty (n=28)
Procedure time, min	7.8 ± 4.37	24.2 ± 13.56
p-value	<0.05	<0.05
Fluoroscopy time, min	3.6 ± 1.98	12.4 ± 10.06
p-value	<0.05	<0.05
Contrast Volume, mL	73.36 ± 16.27	123.39 ± 49.59

Table 3: Cardiac catheterization and coronary angioplasty. The reference values of p-value were >0.05 with statistical difference.

Discussion

During the dTRA access through the anatomical snuff, in the dorsal region of the hand, was initially described with the objective of recanalizing occluded retrograde radial arteries [14,15]. It was soon proposed as an alternative arterial access route, aiming at preserving the patency of the entire radial artery, and could be used in future surgical procedures [16]. The technique awakens curiosity in the midst of interventional cardiology, since it allows the cannulation of the vessel that has become the first choice as access for diagnostic procedures or coronary interventions, especially in the case of acute coronary syndromes, see the recent updates of the European and Brazilian guidelines [17,18].

After the publication of the work of Dr. Kiemeneij, we aimed to reproduce the technique in different services and through different haemodynamicists, which would allow evaluating if there is facility in its routine application in the real world. However, unlike the original work, there was no exclusive indication of left access and, in fact; most patients were treated on the right side. The major use of the right upper limb (87.3%) is explained by the fact that the focus was to reproduce the puncture technique, since after obtaining the access; the procedure is extremely similar to any other performed by conventional TRA.

When puncture was performed on the left side, the main reason was the fact that the patient was previously revascularized with Left Mammary Artery Graft. In this way, access was obtained from the left side in the usual way or from the right side of the patient, with the left hand positioned towards the right groin. This somewhat more ergonomic mode proved to be very comfortable for the operator. However, performing the puncture on the left side of the patient did not impose any additional difficulties.

An observation to be taken in these cases is that, when the patient presents some degree of respiratory discomfort and uses the abdominal breathing more intensely, there is much oscillation of the hand at this moment, which may hinder not the correct palpation of the pulse, but its puncture. Regarding the feasibility and incidence of complications, it has already been shown that there are no differences between the two sides, despite discrete differences in favour of the left radial in terms of a shorter fluoroscopy time and a lower volume of contrast used [19-20]. We speculate if this small disproportion is not due to the fact that we find more tortuosity when navigating the Brachiocephalic Trunk, which does not occur on the left side.

Regarding the technique of puncture, own needles were used for radial procedures or devices like Jelco® or Abbocath® numbers 20 and 22. We tried to obey an angle of inclination of 30 to 45 degrees, with its tip directed to the medial plane, targeting the portion of the wrist where the traditional access is made. The trans-fixation of the artery should be avoided, since the trapezius and scaphoid bones are located below, and the inadvertent touch in the periosteum of these structures is somewhat painful. The spasmolytic solution did not differ from usual, and we routinely administered 5000 units of heparin with 10 mg of isosorbide mononitrate diluted in 10 ml of saline solution. The positioning of the introducer was, for the most part, very smooth.

For diagnostic catheterization a 5 French multipurpose catheter was frequently used. When there was a need for different catheter curves or in cases of angioplasty, we used routine materials for by the femoral approach. In patients of large stature with long upper limbs, it is well known that conventional TRA access eventually causes the catheter used to reach the ostia of the coronary arteries at the limit of their length. It was noted that, when using the anatomical snuffbox, this distance between the entry point in the skin to the coronary artery increases by a few centimetres, which could even render procedures unviable in large individuals. This may represent a possible drawback of the method, but that the making of dedicated catheters and a slightly longer length could easily supplant.

An advantage of the dTRA pathway is to preserve the conventional puncture site of the radial on the wrist, since it is becoming increasingly frequent the need for multiple procedures in the same patient, due to the increase in life expectancy, as well as increased comorbidities which contribute to the development of atherosclerotic disease. There is no tissue trauma or vascular trauma at the usual site, nor does it suffer the effects of prolonged haemostatic compression or even with excessive intensity. However, a relevant perception during patient selection was that, in many individuals who had a normally palpable radial pulse at the wrist height, the pulse in the anatomical snuffbox region was either too thin or imperceptible.

The disadvantage of the smaller caliber of the vessel, which certainly decreases the eligibility for the technique, has led us to suppose that this may not be an access to become a standard in interventional cardiology, but a good option in selected cases, especially on the left side.

Another advantage that emerges from the present study is that the dTRA access safety profile closely resembles the conventional TRA profile, since a minimal incidence of haemorrhagic complications was detected and there was no loss of pulse. In fact, in a sample [21] of 472 patients who underwent coronary angioplasty with conventional TRA using the same operators, the incidence of asymptomatic pulse loss in the in-hospital period was 4%. The maintenance of the wrist arises as an interesting advantage by the possibility of repeating the puncture in the same place, when necessary. Due to the similarity of the advantages of the two techniques, dTRA access can become another access route in which there will be possibility of early discharge, even on the same day. Data from the Brazilian reality [22,23] already begin to confirm the safety of this strategy, provided that a period of observation of about 6 hours is observed in selected patients.

Finally, we found it interesting to note that after the patient was selected for the dTRA puncture, there were no major differences compared to a conventional ART procedure. Even including a reasonable number of acute patients, there were no significant increases in the time of the examination, nor in the time of fluoroscopy. A consistent retrospective analysis of 26238 patients who underwent diagnostic or coronary interventions over a 7-year period at a single centre in northern India points to an average fluoroscopy time in a radial diagnostic procedure of 4.4 ± 3, 55 min and radial angioplasty of 13.5 ± 2.53 min [23]. Thus, the average times found in this initial study do not escape the expected standards and may even be slightly below. Still, it seems to us that the learning curve may be even more extensive than that for conventional TRA access, especially because we are dealing with a smaller vessel.

Conclusion

The dTRA access in the anatomical snuffbox region was shown to be safe and feasible when performed by experienced operators in the conventional TRA puncture, being the method previously described in the literature highly reproducible in patients selected within a daily series of diagnostic catheterizations and angioplasties. Once the puncture is obtained, the procedure follows the usual parameters of the well-known TRA access. The technique deserves a careful look at the scientific community, since it may represent a refined alternative of arterial access.

Conflict of Interests

There is no conflict of interest between authors.

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