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Original Article

Reasons to Use the Femoral Access in a Center that Prioritizes the Radial Access in Invasive Cardiac Procedures

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ABSTRACT

Background: The radial access has been incorporated in many centers as the technique of choice for cardiac invasive procedures. However, there is still resistance to its use, which is mainly related to the possibility of crossover to the femoral access, caused by technical difficulties or vascular anatomic alterations. The aim of this study was to identify the reasons for the use of the femoral access in a center with moderate volume of interventions, which recently adopted it as the technique of choice for invasive cardiac procedures. **Methods**: Prospective study including consecutive patients undergoing elective cardiac catheterization and coronary angiography. A data form was filled out containing pre-, peri-, and postprocedure information, with emphasis on the evaluation of the causes to use the femoral access (crossover or first choice). **Results**: From November 2013 to August 2014, a total of 1,290 patients underwent an elective diagnostic procedure. The femoral access was used in 10.9% of the patients, as the operator's first choice in 6.6% and due to crossover in 4.3% of the cases. Crossover resulted from puncture failure (3.4%), arterial spasm (0.6%), or vascular tortuosity (0.3%). Immediate complications were observed in six patients (0.5%) who developed local hematoma (type I and type II). **Conclusions**: In a moderate-volume center the radial access was incorporated as first choice with safety and a low incidence of crossover to femoral access.

DESCRIPTORS: Radial artery. Femoral artery. Cardiac catheterization. Percutaneous coronary intervention.

RESUMO

Razões para Utilização da Via Femoral em Centro que Prioriza Técnica Radial em Procedimentos Cardiovasculares Invasivos

Introdução: A técnica de acesso arterial radial tem sido incorporada em muitos centros como técnica de escolha para procedimentos invasivos cardíacos. No entanto, ainda há resistências relacionadas principalmente a possibilidade de *crossover* para via femoral, causadas por dificuldades técnicas ou alterações anatômicas vasculares. O objetivo deste estudo foi identificar as razões para a utilização da via femoral em um centro de médio volume de intervenções, que recentemente adotou essa técnica como primeira escolha na realização de procedimentos invasivos cardíacos. **Métodos**: Estudo prospectivo, que incluiu pacientes consecutivos submetidos a cateterismo cardíaco e coronariográfica de forma eletiva. O preenchimento de formulário foi realizado com informações pré, per e pós-procedimento, e foi dada ênfase à avaliação das causas da utilização da via femoral (*crossover* ou por escolha primária do operador). **Resultados**: No período de novembro de 2013 a agosto de 2014, 1.290 pacientes foram submetidos a procedimento diagnóstico eletivo. A via femoral foi utilizada em 10,9% dos pacientes, por escolha do operador em 6,6% ou por *crossover* em 4,3% dos casos. O *crossover* ocorreu por punção inadequada (3,4%), espasmo arterial (0,6%) ou tortuosidade vascular (0,3%). As complicações imediatas foram observadas em seis pacientes (0,5%) que desenvolveram hematomas locais (tipos I e II). **Conclusões**: Em um centro de moderado volume, a técnica radial foi incorporada como primeira escolha com segurança e baixa incidência de *crossover* para a via femoral.

DESCRITORES: Artéria radial. Artéria femoral. Cateterismo cardíaco. Intervenção coronária percutânea.

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The use of the radial approach for invasive cardiovascular procedures is highly variable in different specialized centers.[1] An increased use of this technique has been observed for both diagnostic and therapeutic procedures. However, in most centers, especially in the United States, the femoral access route is still the preferred choice.[1,2]

The radial access route has been shown to be adequate, since it significantly reduces the occurrence of vascular bleeding complications, promotes rapid ambulation, and reduces costs when compared with the femoral approach. Some studies have associated the lower incidence of hemorrhagic complications of the radial route with a lower mortality rate.[3-5]

Underutilization of the transradial approach has been related to technical difficulties and to challenges that must be overcome, due to anatomical variations, vascular spasm, and changes in vascular trajectory, including the aortic arch. The radial approach is often not used in centers with low- to moderate-volume of procedures.[6-8]

Recent studies in centers that routinely use the radial route have observed a 2% rate of crossover to the femoral approach due to failure to perform the programmed procedure via the radial approach, and approximately 3% as incidence of femoral access as the primary choice, for reasons such as history of previous coronary artery bypass graft (CABG) surgery or known occlusion of the radial artery.[4] In most centers, in cases of intervention in patients with cardiogenic shock, the preferred approach has been the femoral route.[6,9]

This study aimed to identify the reasons for using the femoral approach in a center with medium volume of interventions, which recently adopted the radial route as first choice in cardiac invasive procedures.

METHODS

The study population consisted of consecutive patients who underwent elective cardiac catheterization and coronary angiography in the Interventional Cardiology Service, Hospital Bruno Born, city of Lajeado (RS). Emergency procedures in patients with acute coronary syndrome with and without ST-segment elevation were excluded. The study was conducted in accordance with the guidelines of the Ethics Committee of the institution, and all patients signed an informed consent form for the procedure.

The pre-procedural information included demographics, risk factors for coronary heart disease, clinical indication for the examination, previous procedures, and access route used. During the procedure, information on access route was collected, as well as sheath caliber, need for digital oximetry, and administration of spasmolytic medication. After the procedure, the occurrence of immediate complications related to the puncture site (hematoma and pseudoaneurysm), asymptomatic arterial occlusion, or the need for surgical vascular repair was recorded.

Definitions

The reasons for using the femoral route could be crossover or primary choice of the operating physician. Crossover to the femoral route was defined as any procedure in which the radial approach could not be used due to puncture failure, arterial spasm, or a tortuosity that could not be surpassed. The reasons for choosing the femoral route as first choice were: previous radial occlusion, CABG, or patient preference.

Hematomata were graded according to the classification of the Early Discharge After Transradial Stenting of Coronary Arteries (EASY) study: type I, ≤ 5 cm in diameter; type II, ≤ 10 cm in diameter; type III, > 10 cm, without reaching the elbow; type IV, hematoma extending beyond the elbow; and type V, any hematoma with ischemic injury to the hand.[10]

Procedure

All patients were examined by the Interventional Cardiology Service nurse for the presence of radial and ulnar pulses. In the case of an absent or decreased pulse, a digital oximetry test was performed. In this protocol, a pulse oximeter was placed on the patient's thumb and the ipsilateral ulnar artery was occluded. Constant values for pulse oximetry indicated uninterrupted blood filling during ulnar occlusion. These patients were reviewed by the operating physician.

The patient was placed with the right or left wrist in slight extension, with antisepsis with chlorhexidine 2%. A local anesthesia with 2-3 mL of 1% xylocaine without vasoconstrictor was carried out. For arterial puncture, Insyte® 20 and a 5 or 6F radial puncture kit (Terumo Medical Corporation – Elkton, United States) were used. The choice of the diagnostic catheter was at the operating physician›s discretion. After the radial puncture, a solution with an ampoule of isosorbide mononitrate (10 mg/mL) and 2,500 U of sodium heparin was administered directly through the side port of the sheath. At the end of the procedure, the sheath was removed by the nurse, with compression of the puncture site for 3 hours.

RESULTS

From November 2013 to August 2014, 1,290 patients underwent elective cardiac catheterization and coronary angiography procedures in this service. Male patients prevailed (61.9%), with a mean age of 61.0 ± 12.5 years; 30.9% were diabetic. Most patients (98%) had clinical indication for an investigation of ischemic

heart disease. Previous diagnosis procedures were performed in 21.9% of patients and 6.6% had undergone intervention via the radial access (Table 1).

In 89.1% of cases, the procedures followed the routine access routes adopted in this service. The right radial route was utilized in 86.1%, the left radial route in 0.5%, and the transulnar route in 2.5% of procedures. The transfemoral approach was used in the other patients (10.9%). This route was used by operating physician›s choice in 85 cases (6.6%), due to previous CABG (5.4%), patient preference (0.6%), or radial artery occlusion (0.5%). Crossover occurred in 56 cases (4.3%), due to inadequate puncture (3.4%), arterial spasm (0.6%), or vascular tortuosity (0.3%) (Table 2).

Immediate post-procedural complications were observed in six patients (0.5%) who developed type I and II hematomata on the forearm. There were no pseudoaneurysms, asymptomatic occlusion of the radial artery, nor need for surgical vascular repair.

DISCUSSION

Despite the proven benefits of using the radial approach in vascular access for coronary invasive procedures, its implementation remains variable in different centers. Some reasons for its sub-utilization are the technical challenges encountered, the learning curve, and the fear of crossover, demonstrated in numerous studies.[6,11-13]

In the present study, it was shown that, in a service with medium volume of procedures (1,500 diagnostic procedures/year and 500 therapeutic procedures/year), where the radial approach was recently adopted as first choice, the procedure can be performed safely and with a low incidence of complications and crossovers to the femoral approach. The incidence of crossovers was 4.3%, and their main cause was an inadequate puncture, reflecting primarily a technical issue, since the artery was not properly addressed. This finding is consistent with the literature.[3,6]

The estimated rate of anatomical changes in patients undergoing radial procedures is 20%.[2,12] However, it was not shown that such changes are a key factor in the failure of the radial approach. One explanation is a more common use manipulation alternative for access with more delicate guides, dedicated catheters, and guides with more support. The use of a spasmolytic combination may have an important adjunct role in the radial procedure, as previously demonstrated.[14] Female gender has been implicated as a risk factor for failure in radial access procedures; however, in the present study, this risk was not verified. The use of heparin with local infusion is controversial and, in this study, a lower dose than recommended was used, as these were elective procedures in stable patients.

One concern about the use of the radial technique is the possibility of a lack of dual circulation in the hands. An access failure could lead to occlusion of the single artery responsible for hand circulation.[8]

TABLE 1
Baseline clinical characteristics

Characteristics	n = 1,290
Age, years	61.0 ± 12.5
Male gender, n (%)	799 (61.9)
Hypertension, n (%)	890 (69.0)
Diabetes mellitus, n (%)	399 (30.9)
Dyslipidemia, n (%)	387 (30.0)
Smoking, n (%)	438 (34.0)
Indication for the procedure, n (%)	
Ischemic heart disease	1.265 (98.1)
Valve disease	25 (1.9)
Congenital heart disease	0 (0)
Previous diagnosis procedures, n (%)	283 (21.9)
Via radial route	85 (6.6)

TABLE 2
Procedure characteristics

Characteristics	n = 1,290
Access route, n (%)	
Right radial	1,111 (86.1)
Left radial	6 (0.5)
Right ulnar	32 (2.5)
Femoral	141 (10.9)
Sheath caliber, n (%)	
5F	447 (34.7)
6F	843 (65.3)
Digital oximetry test, n (%)	90 (6.9)
Reasons for using the femoral approach, n (%)	
Crossover	56 (4.3)
Inadequate puncture	44 (3.4)
Arterial spasm	8 (0.6)
Vascular tortuosity	4 (0.3)
Primary choice	85 (6.6)
Previous coronary artery bypass graft surgery	70 (5.4)
Patient preference	8 (0.6)
Previous radial occlusion	7 (0.5)
Immediate complications, n (%)	6 (0.5)
Hematoma	6 (0.5)
Pseudoaneurysm, surgical vascular repair	0 (0)

Verification techniques for the presence of an adequate circulation have been described, and its absence would be a contraindication for the procedure with this approach. In a large retrospective study on radial approach use, it was found that no test was applied prior to the examination in 23% of the centers.[8] In the present study, the evaluation of blood circulation was left to the nurse's discretion. The established standard was the mere palpation of the radial and ulnar pulses. The operating physician revised the pulses at the time of puncture, and to digital oximetry was needed in only a few cases. When oximetry was necessary, the test revealed cases of radial occlusion, with crossing between access routes. The authors believe that the practice of evaluation by the nursing team, reviewed by the operating physician, is safe and with low risk of complications.

CONCLUSIONS

In this interventional cardiology service, the radial access technique was recently chosen as the first choice and, due to the a medium volume of procedures, the team is still gaining experience and expertise with the technique, which has proven to be safe, effective, and had an important impact in decreasing bleeding complications and mortality. The crossover incidence was close to those of centers with a large use of the radial access, which encourages to the increased use of this technique.

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CONFLICT OF INTERESTS

The authors declare no conflicts of interest.

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