DISTAL TRANSRADIAL ACCESS. INITIAL EXPERIENCE. RESULTS

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Introduction: Conventional access through the radial artery (cTRA) is a standard approach in coronary interventions. Unfortunately, it carries a risk of long-term complications such as radial artery occlusion (RAO) and local complications, usually hematomas. Aim: Sharing initial experience in the application of distal transradial access (dTRA) on 134 patients, from single operator in one center and its applicability on patients with STEMI. Number of procedures required to get experience with this access, assessed by the degree of reduction of failed procedures. Materials and methods: From 08.03.21 to 18.11.21, 134 patients with dTRA (110 successful, 24 unsuccessful) were included in the study. dTRA is considered to be an access to the anatomical snuffbox. Completion of the entire procedure, not just a successful puncture or insertion of an introducer, was considered the access successful. Results: It was found that the success of the method was 82% of the criteria preset. Among the successful procedures, 48% were interventions. Of these, 71% had ACS and 43.6% had STEMI. The access was used on 3 patients who had CTO. Two patients underwent rotablation using a 7 in 6 Fr introducer. On 98% of the patients a 6 Fr introducer was used. Right dTRA was used on 93% of patients. From the 134 procedures performed, it was found that 92% of failures were up to the 80th procedures. After the 80'th procedures the frequency of failures decreased significantly. Complications - 3 small hematomas and 2 numbness in the thumb, which did not require additional interventions. Conclusion: The procedure with dTRA was successfully completed by high
Peripheral arterial access methods in coronary angiography and coronary interventions have undergone significant development in the past few years [1, 2]. Nowadays, the transradial approach is preferred over the transfemoral approach due to the lower incidence of puncture site complications comfort, opportunity for same-day discharge and reduced mortality in STEMI patients [3, 4]. Radial artery occlusion (RAO) is the main disadvantage of transradial access. Due to the frequent absence of symptoms, it is difficult to estimate the true frequency of these complications. The frequency of RAO ranges from 0.8 to 30% [5] and varies, depending on the evaluation time of arterial patency. It occurs in 7.7% during the first 24 hours according to meta-analysis of Rashid [6]. When ultrasound is used for the diagnosis of RAO (instead of the absence of palpable arterial pulsations), the rate increases to 32.9% [7].

Although most cases of occlusion are occult and lack of ischemic syndrome, RAO can impede repeated use of the same artery for future coronary interventions, for coronary artery bypass graft or haemodialysis fistula preparations. In modern societies with increased life expectancy, the likelihood of multiple interventions through the radial artery is increasing.

Another disadvantage of radial approach is that in some patients with orthopedic injuries, it might be difficult to keep their wrist in the supine position, the radial access is complicated or even impossible.

In 2011, Babunashvili A et al. [8] first described their experience with retrograde recanalization of the occluded radial artery via distal transradial access (dTRA). Kaledin et al. [9] described dTRA as the default technique for coronary procedures, and Roghani-Dehkordi et al. [10] highlighted the advantages of dTRA compared to cTRA at a Middle Eastern transluminal course in 2016. In 2017, Kiemeneij shared the experience of 70 selected patients who underwent cardiac catheterization via the left dTRA at the anatomic snuffbox [11] in EuroIntervention. After this publication a large number of case reports, case series and even randomized study (some of which are being conducted at the moment) have been accumulated.
They show the safety and efficiency of dTRA and also its advantages and disadvantages compared to cTRA by different types of coronary interventions [12, 13, 14, 15].

Advantages of dTRA

1. Low rate of RAO – due to the maintenance of antegrade flow through the superficial palmar arch. The forearm radial artery does not thrombose in case of compression of distal radial artery for haemostasis, even after occlusion of distal radial artery. The study “Distal Radial Artery Approach to Prevent Radial Artery Occlusion Trial” showed a significant reduction of RAO, at 24th hour and also on 30th day [16]. According to other authors the rate of RAO in dTRA approach was decreased by 90% compared with cTRA approach (0.4% vs. 4.2%) [17].

2. Lack of venous stasis because of the absence of major venous vessel compression

3. Saving the radial artery for possible future coronary artery bypass grafts or for hemodialysis fistulas preparations.

4. Faster haemostasis, low risk for hematoma formation, and compartment syndrome due to anatomical characteristics of snuffbox [18, 19, 20]. The expected smaller diameter and lower blood flow velocity of the distal radial artery provide a relevant opportunity for systematically shorter and non-occlusive haemostasis. [21]

5. The arm position during the intervention is comfortable and natural for the patient. No devices are needed to fix the patient’s arm for left-hand access. Enables the operator to work from a safe distance from the radiation source with left access

6. Potential site for retrograde recanalization of occluded radial artery [22].

Disadvantages

1. Technical – training period is needed to reach some skills in access.

2. The short length of catheters is a significant drawback to the snuffbox technique. Given that the snuffbox artery is 5 cm below the common radial entry site, these catheters may, therefore, be too short, especially in taller patients [23].

3. Anatomical features, which complicate the access – arthritis and deformations in the area of the first carpometacarpal joint – (Trapeziometacarpal osteoarthritis – Rhizarthrosis).

Materials and methods

Method of puncture and anatomical markers were described in detail in the referred literature. According to those references puncture in anatomical snuffbox of hand’s dorsal surface is being used [24].
In the beginning two elective patients were selected who had well-represented anatomical markers and strong pulsations in site of the anatomical snuffbox. In the first patient a left dTRA was performed. The second one underwent a right dTRA. Until reaching the 20th successful procedure, patients with cardiogenic shock, absent distal radial artery pulse in the anatomical snuff box, height greater than 185 cm, and those with weakened distal radial artery pulsations (poorly palpable pulse) were excluded. Inclusion was independent of whether patients had ACS (STEMI) or stable angina pectoris (SAP). After the 20th procedure, patients with a poorly palpable pulse were also included, excluding those with cardiogenic shock, absent distal radial artery pulse in the anatomical snuffbox site, height over 185 cm (the tallest patient with successful dTRA was with height of 185 cm), and patients who had heavy deformations of the arm according to the Rizartrozis type. Inclusion was again independent of whether patients had ACS (STEMI) or stable angina pectoris (SAP).

According to the published data of 24 investigators in pull of more than 20 patients, successful access ranges from 70-100% [25]. However, we must keep in mind some features that may affect the results.

In some publications, success is defined when the needle successfully punctures the vessel, in others it is defined by successful placement of an arterial introducer.

A difference is also obtained when using ultrasound during the puncture. In one study comparing the use of ultrasound in dTRA, access success increased from 87 to 97% [26].

In some studies, operators have already undergone an initial period of training (at least three months) or performed more than 100 dTRA procedures before starting the study [27].
In this observation, success is defined by the successful completion of the entire procedure, whether diagnostic or interventional. This leads to a lower success rate, since in 5 of the unsuccessful cases we have a successful puncture, but an inability to pass with a wire. An introducer was placed by 1 patient, but the procedure was not completed due to tortuosity of the truncus brachiocephalicus and inability to maintain a stable position of the guiding catheter.

In some studies few patients with STEMI were included because they are discussed to be a likely predictor of dTRA failure (OR = 2.54, P = 0.180) [28].

TR Band Terumo, placed in the puncture site in the anatomical snuffbox, were used for haemostasis.

### Results

For the period from 08.03.2021 to 18.11.2021 – 134 non-consecutive patients were treated (110 successful, 24 unsuccessful). In the beginning they were two selective stable patients with left and right dTRA. Subsequent patients were included regardless of whether they had ACS (STEMI) or stable angina pectoris (SAP). The difference was that until the 20th procedure, those with poorly palpable (weakened) pulsation were not included. In the very first 20 procedures 3 of them had STEMI. Without pretreining period. Without usage of ultrasound (Table 1).

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Въпреки утежнените изисквания за завършване на процедурата, не само канюлация на артерията, резултатите са окраяващи по отношение приложимост на дистя – 82% успешни. Един достъп е ефективен при завършена процедура. От успешни те процедури 48% са били интервенции. От тях с ОКС са 71%, като 43,6% са със STEMI. При 3-ма пациенти е използван достъпът за СТО. При двама е извършена ротаблация с използване на интодюсери 7в 6 Fr. При дваца са използвани 5 Fr (един пациент) и 5 в 4 Fr интродюсери(един пациент) – да се коригира – НА При двама са използвани 5 Fr (един пациент с 5 Fr и един пациент 5 в 4 Fr) интродюсери. При 93% от болни се използва десен dTRA. От извършените 134 процедури се установява, че 92% от неуспешните случаи са до 80-а процедура. След 80-ата процедура честотата на успешните случаи значително намаля. Усложнения – 3 малки хематома и 2 изтръпвания при палец, не са се наложили допълнителни интервенции. За хемостаза са използвани TR Band Terumo.

Наблюдава се по-голяма честота на неуспешни процедури при жени, което е установено и при други студии и вероятно е свързано с по-ниската телесна маса, по-малкия калибър на дисталната радиална артерия и по-голямата склонност към спазъм. От 5 случая, при които спазът е бил причинен за неуспешна канюлация, 4 са при жени. При 5 пациенти е налице успешна пункция, но невъзможност за преминаване с водах в радиалната артерия, което вероятно е свързано с изразената ангулация при прехода на дисталната радиална артерия в радиалната артерия. Тази ангулация се преодолява при голема част от случаите, като се помоли пациентът да захване палеца си с останалите пръсти на ръката и да отведе улнарно ръката си. Още при първите 20 пациенти е забелязано, че изразената деформация по типа на Rizartrozis (трапециоидметакарпален остеоартрит) затруднява достъпа поради промяна на анатомичните маркери за пункция и невъзможност за използване на малъври за преодоляване на ангулацията на артерията и затова впоследствие, когато е изразена деформацията, не са включени. Когато пулсаците на дисталната радиална артерия не са силно изразени, е било затруднено и канюлирането на артерията. В такъв случай пациентът е извършвал екстензия на палеца за подобряване на ориентирането по анатомичните маркери на snuffbox (както е показано на снимката) и локализиране на мястото за пункция. При един пациент имаме успешна пункция с поставяне на интродюсер, но поради тортуозност на truncus brachiocephalicus процедурата не е завършена, като той също е бил включен в неуспешните процедури.

Despite the aggravated requirements for completion of the procedure, not just cannulation of the artery, the results are encouraging in terms of applicability of the access – 82% successful. One access is considered effective when the procedure is fully completed. Forty eight percent of the successful procedures were interventions. Of these, 71% had ACS and 43.6% had STEMI. This access was used in 3 patients who had CTO. In two patients a rotablation was performed, using an introducer 7 in 6 Fr. In one patient 5 Fr and in another one 5 in 4 Fr introducers were used. Ninety eight percent of patients had a 6 Fr introducer. Right dTRA was used in 93% of patients. Of the 134 procedures performed, it was found that 92% of failures were up to the 80th procedure. After the 80th procedure, the frequency of failures decreased significantly. Complications – 3 small hematomas and 2 numbness in the thumb, did not require additional interventions. TR Band Terumo was used for haemostasis.

There was a higher frequency of failed procedures in women, which has been found in other studies and this probably is related to lower body weight, smaller caliber of the distal radial artery and a greater tendency to spasm. Women were 4 of the 5 cases, in which the spasm was the cause of failed cannulation. In 5 patients there was a successful puncture, but inability to pass with a wire in the radial artery, which was probably associated with the curvilinear course of the distal radial artery to the radial artery. In most cases this angulation can be overcome by asking the patient to grasp the thumb with the other fingers of the hand and to make ulnar deviation of the hand. Already by the first 20 patients it was noticed that the great deformation of the Rizartrozis type (trapezoid metacarpal osteoarthritis) complicates the access due to changes in the anatomical markers for puncture and the inability to use manoeuvres in order to overcome artery angulation. Therefore, subsequently such cases (patients with pronounced deformations), were not included. When pulsations of the distal radial artery were not strong enough, arterial cannulation also caused difficulty. In this case, the patient had to perform extension of the thumb to improve the orientation of the snuffbox's anatomical markers (as shown in the photo) and localization of the puncture site. In one patient we had a successful puncture with the placement of an introducer, but due to tortuosity of the truncus brachiocephalicus the procedure was not completed, so that particular patient was also included in the unsuccessful procedures.
Недостатъци на студията са:
1. Не е измервано времето, необходимо за канюлация. В тази серия пациенти няма предварителни тренировки на канюлация, проследен е ежеседмичен период на обучение и цепта е успешно завършена процедура. Времето за канюлация е изследвано в множество обзори и се доказва, че прогресирано се скъсява с увеличаване на броя на процедурите. Bambhani [29] извършва канюлации на dTRA при 100 пациенти и установява, че след първите 25 пациенти времето за канюлация се скъсява наполовина за следващите 25. Lee установява, че времето за канюлация се стабилизира след 150 процедури [30].
2. Не е изследвана честотата на оклузия на радиалната артерия. Много доказателства са налични за ползата от dTRA по отношение превенция на оклузията на радиалната артерия. При dTRA значително се редуцира рискът от проксимално разпространение на тромбозата в радиалната артерия. Скоростни студии с използване на OCT показват ниска честота на увреждане на радиалната артерия при коронарни процедури, използвайки dTRA [31] в сравнение с cTRA [32].

Сега са в ход много проучвания в тази насока – Forearm radial artery occlusion CORRECT Radial, Forearm radial artery occlusion DAPRAO, Forearm radial artery occlusion DISCO Radial, Early forearm radial artery occlusion DIPRA, Motor hand function DRAMI.

Заключение

При това проследяване на пациенти се установява, че успешността на метода е висока при ниска честота на усложнения. По тази причина новият dTRA се явява алтернатива на cTRA с цел запазване на хирургическото разполагане на радиалната артерия, както е наблюдавано в множество проучвания [16, 17, 31, 32]. Това е от особена важност при повишения брой пациенти, които претърпяват интервенции. Този нов достъп не изисква специални консумативи или апаратура. Недостатък е трудността при канюлация, която се преодолява след обучение. Дължината на катетрите при много високи пациенти може да се окаже недостатъчна. Комфортът за пациента е много по-голям. Достъпът е приложен при всички коронарни интервенции, включително и при високоризкови пациенти със STEMI.

Не е деклариран конфликт на интереси

Библиография
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Disadvantages of the study are:
1. The time required for cannulation has not been measured. In this pull of patients there was no preliminary training of cannulation, so of interest was the length of the self-study period, and the goal was a successfully completed procedure. Cannulation time has been studied in numerous reviews and has been shown to progressively shorten with increasing number of procedures. Bambhani [29] performed dTRA cannulations on 100 patients and found that after the first 25 patients the cannulation time was halved for the next 25. Lee found that the cannulation time stabilized after 150 procedures [30].
2. The frequency of radial artery occlusion has not been studied. Much evidence is available for the benefit of dTRA in preventing radial artery occlusion. With dTRA, the risk of proximal spread of radial artery thrombosis is significantly reduced. Recent studies using OCT have shown a low incidence of radial artery damage in coronary procedures using dTRA [31] compared to cTRA [32].

Many studies in this regard are now being conducted – Forearm radial artery occlusion CORRECT Radial, Forearm radial artery occlusion DAPRAO, Forearm radial artery occlusion DISCO Radial, Early forearm radial artery occlusion DIPRA, Motor hand function DRAMI.

Conclusion

In this follow-up of patients, the success of the method was found to be high with a low incidence of complications. For this reason, the new dTRA is an alternative to cTRA in order to preserve the patency of the radial artery, as observed in many studies [16, 17, 31, 32]. This is particularly important by the increased number of patients undergoing interventions. This new access does not require special consumatives or equipment. The disadvantage is the difficulty in cannulation, which can be overcome after training. Catheter length by very tall patients may be insufficient. The comfort for the patient is much greater. The approach is applicable to all coronary interventions, including high-risk patients with STEMI.

No conflict of interest was declared

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