

## Early ambulation after femoral percutaneous transluminal angioplasty - Report of 02 cases

### Deambulação precoce após angioplastia transluminal coronária por acesso femoral - Relato de dois casos

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**RESUMO | INTRODUÇÃO:** No Brasil e no mundo ainda é abundante o número de serviços hospitalares que restringe a realização de exercício nos indivíduos submetidos à angioplastia transluminal coronária (ATC), no período pós-operatório imediato, por receio de complicações. É importante demonstrar que a Fisioterapia cardiovascular pode ser realizada nessa população. **OBJETIVO:** Verificar os efeitos adversos no desempenho da deambulação precoce após ATC, com o uso de um dispositivo mecânico de oclusão arterial na punção femoral. **POPULAÇÃO E MÉTODOS:** Relato de dois casos (um homem de 68 anos e uma mulher de 57 anos) submetidos à ATC de um único vaso (artéria coronária direita e ramo diagonal, respectivamente) que tiveram sua punção realizada por via femoral, associada ao dispositivo de fechamento arterial Angio-Seal - St. Jude Medical®, que receberam alta do hospital após seis horas do término da intervenção. Os pacientes apresentavam, antes da ATC, angina estável e fatores de risco cardiovascular (dislipidemia, hipertensão e outros). Após a ATC, os pacientes foram avaliados pela equipe, que monitorava intercorrências durante a internação (dor no peito, desconforto ventilatório, eletrocardiograma, enzimas cardíacas e outras). A marcha dos indivíduos era verificada, no sentido de se avaliar a tolerância dos indivíduos à mesma, após cinco horas da realização da ATC. Os indivíduos eram orientados a caminhar em ritmo leve (Borg modificado entre 1-3) por cinco minutos em um corredor de aproximadamente 15 metros, em movimentos de ida e volta, sendo avaliados após a deambulação quanto ao surgimento de hematoma no sítio da punção, dores ou quaisquer complicações que surgissem. No primeiro dia de pós-operatório foi realizado um telefonema para segunda checagem de complicações. **RESULTADOS:** Ambos toleraram a realização dos cinco minutos de marcha e foram liberados do hospital após seis horas, deambulando sem intercorrências. Um dos pacientes referiu cefaleia de baixa intensidade durante a internação. A mesma paciente referiu dor de baixa intensidade no local da punção arterial no dia seguinte. Não se verificaram alterações clinicamente relevantes nos parâmetros cardiovasculares ou ventilatórios durante as seis horas de internação pós-operatória ou durante a deambulação. **CONCLUSÃO:** A realização de deambulação precoce dentro de seis horas após a ATC foi bem tolerada nos dois casos estudados, mesmo com o sítio de acesso arterial femoral. O uso de dispositivo mecânico de fechamento arterial foi importante para que se pudesse realizar a deambulação nessa população.

**PALAVRAS-CHAVE:** Fisioterapia. Reabilitação. Angioplastia.

**ABSTRACT | INTRODUCTION:** In Brazil and around the world, there is still an abundance of hospital services that restrict exercise in individuals undergoing percutaneous coronary interventions (PCI), in the immediate postoperative period, for fear of complications. It is important to demonstrate that cardiovascular physical therapy can be performed in this population. **OBJECTIVE:** To verify the adverse effects in the performance of early ambulation after PCI, with the use of a mechanical device of arterial closure in the femoral puncture. **POPULATION AND METHODS:** Two cases (68-years-old man and 57-years-old woman) submitted to a single-vessel coronary artery (right coronary artery and diagonal branch, respectively) that had their femoral puncture associated with the device Angio-Seal - St. Jude Medical®, who were discharged from the hospital six hours after the intervention. Before PCI, patients had stable angina and cardiovascular risk factors (dyslipidemia, hypertension, and others). After the PCI, the patients were evaluated by the Heart Team, who monitored intercurrents during hospitalization (chest pain, ventilatory discomfort, electrocardiogram, cardiac enzymes and others). The gait of the individuals was verified, in order to evaluate the tolerance of the individuals to the same, after five hours of the PCI. Individuals were advised to walk in a light rhythm (modified Borg 1-3) for five minutes in a corridor of approximately 15 meters, in round-trip movements, and were evaluated after ambulation for hematoma at the puncture site, pain or any complications that might arise. On the first postoperative day, a telephone call was made for a second complication check. **RESULTS:** Both patients tolerated the five-minute walk and were released from the hospital after six hours, wandering uneventfully. One of the patients reported low-intensity headache during hospitalization. The same patient reported low-intensity pain at the puncture site the next day. There were no clinically relevant changes in cardiovascular or ventilatory parameters during the six hours postoperative hospitalization or during ambulation. **CONCLUSION:** Early ambulation within six hours after PCI was well tolerated in the two cases studied, even with the femoral artery access site. The use of a mechanical device for arterial closure was important so that the ambulation could be carried out in this population.

**KEYWORDS:** Physiotherapy. Rehabilitation. Angioplasty.

## Introduction

In Brazil and around the world, the number of hospital services that restricts exercise in individuals undergoing coronary transluminal angioplasty in the immediate postoperative period is still abundant, for fear of complications. It is important to demonstrate that cardiovascular physical therapy can be performed in this population<sup>1</sup>. Vascular closure devices (VCDs) were developed to reduce access site bleeding, to improve patient comfort, and to accelerate ambulation after percutaneous coronary interventions (PCI)<sup>2</sup>. Such devices are not well known by physiotherapists. Finally, there is no stimulus to early ambulation after femoral PCI, due to fear of bleeding or other complications.

It is important to emphasize that individuals with diseases that affect the cardiovascular system have, in most cases, limitations in their functionality that end up compromising the quality of life of this population, due to the consequent physical inability to perform activities of daily or professional life. Several mechanisms are proposed by the scientific literature in order to clarify the causes of functional limitation, such as cardiac pump failure and peripheral components, such as the loss of muscle mass secondary to an exacerbated inflammatory response present in patients with neurohumoral alterations, characteristics of the chronic cardiopathy<sup>3</sup>. Often individuals with heart disease, for fear of making efforts after hospital procedures, end up decreasing their pace of physical activity intensely. Introducing the early ambulation may motivate them to maintain greater intensity of effort at the time of hospital discharge and beyond.

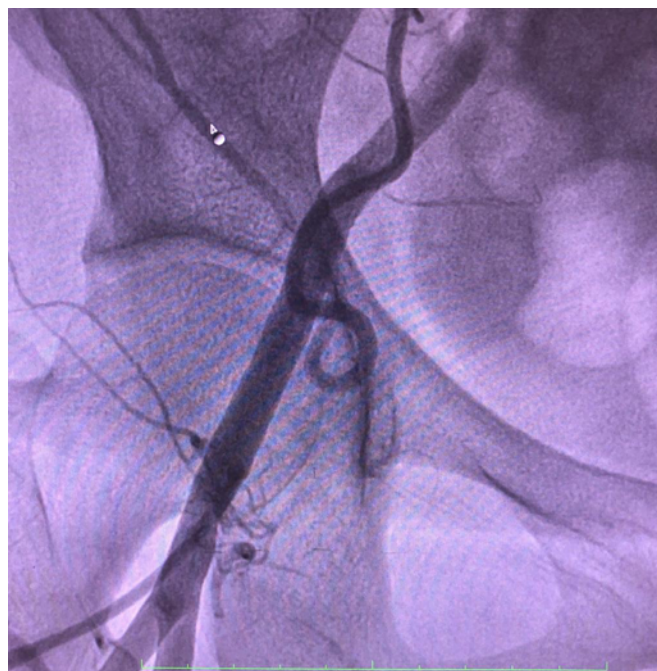
The aim of this article is to verify the adverse effects in the performance of early ambulation after PCI, with the use of a mechanical device of arterial closure in the femoral puncture.

## Methods

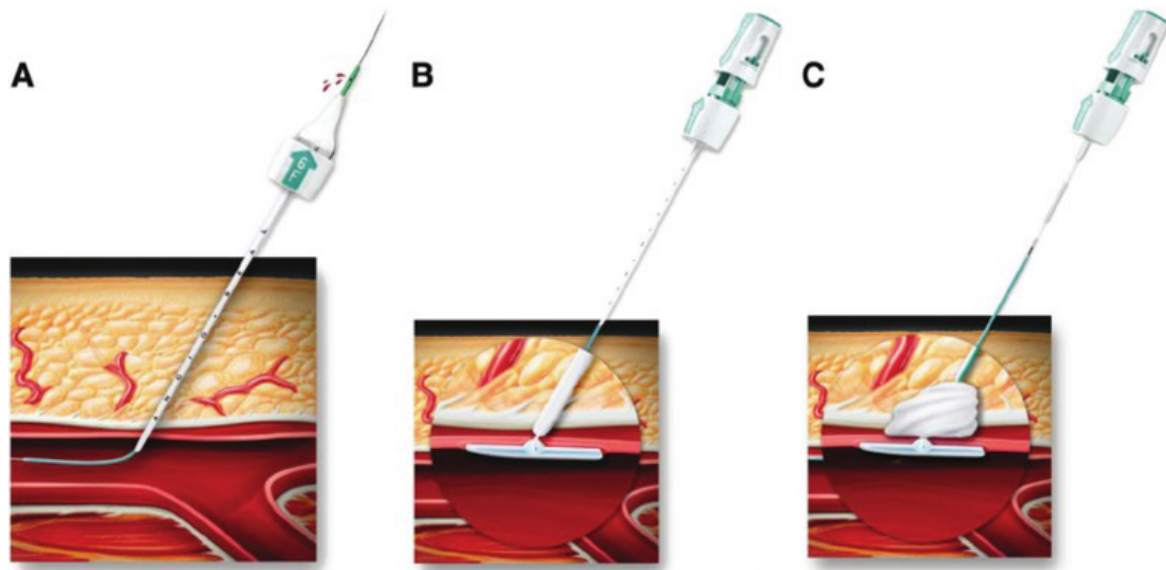
The present case reports were evaluated by the research ethics committee of the Emergency Hospital of Goiania, linked to the Brazil Platform, receiving its approval under the number CAAE: 85497418.2.0000.0033.

Two individuals were submitted to PCI and had their femoral puncture (figure 1) associated with the use of the device *Angio-Seal - St. Jude Medical*® after the procedure. An example of the VCD *Angio-Seal*® (*St. Jude Medical, St. Paul, Minn.*) is given in figure 2. Characteristics of the sample are displayed in Table 1.

**Figure 1.** Example of introducer inserted in the femoral artery, for cardiac catheterization. In order to allow the agile transit of several catheters, there is a semi-rigid introducer, through which occurs the passage of these catheters



**Figure 2.** Vascular closure device. a. Angio-Seal® (St. Jude Medical, St. Paul, Minn.). The device is made of three absorbable components: a small anchor, collagen, and a suture. From A to C. The anchor is placed in the artery via a sheath and then drawn against the wall of the artery, while the suture allows the collagen to compact to create a seal over the entry point in the artery.



**Table 1.** Sociodemographic and clinical characteristics of two cases, early ambulation after ATC, with the use of a mechanical device of arterial occlusion in the femoral puncture

	Age (years-old)	Gender	BMI	Hb/Ht	Cr	General pre-PCI status
Patient 1	68	Male	25.0	14.1/44.8	1.4	Good
Patient 2	57	Female	31.8	16.8/46.9	0.7	Good

BMI = body mass index (kg/m<sup>2</sup>); Hb = hemoglobin (g/100ml); Ht= hematocrit (%); Cr= creatinine (mg/dl)

After the PCI, the patients were evaluated by the Heart Team, who monitored interurrences during hospitalization (chest pain, ventilatory discomfort, electrocardiogram, cardiac enzymes and others). They underwent a physical-clinical evaluation that included collection of the physiological variables during the postoperative period (DX 2022 Dixtal vital signs multi-parameter monitor®, AM, Brazil): heart rate (HR), SpO<sub>2</sub>, systolic blood pressure (SBP) and diastolic blood pressure (DBP).

### Ambulation procedure

The ambulation (gait) of the individuals was verified (figure 3), in order to evaluate their tolerance to the same, after five hours of the PCI. Individuals were advised to walk in a light rhythm (modified Borg 1-3) for five minutes in a corridor of approximately 15 meters, in round-trip movements, and were evaluated after ambulation for hematoma at the puncture site, pain or any complications that might arise. On the first postoperative day, a telephone call was made for a second complication check.

**Figure 3.** Example of an Individual walking in a light rhythm (modified Borg 1-3) for five minutes in a corridor of approximately 15 meters, in round-trip movements. After ambulation the patient was evaluated seeking for hematoma at the puncture site, pain or any complications that might arise



### Case reports

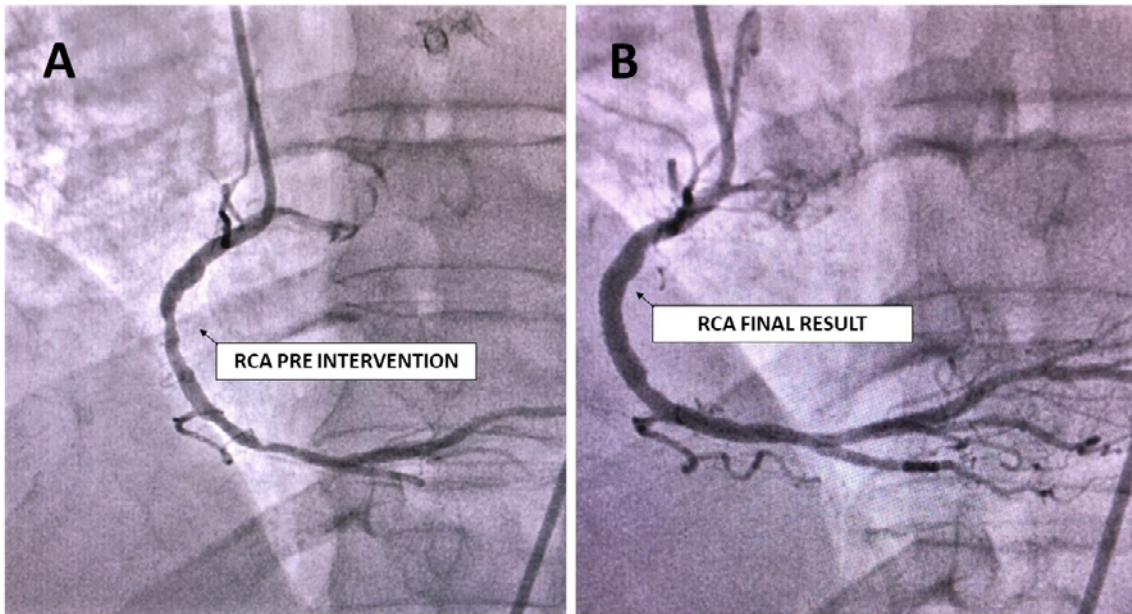
Patient 1 has diabetes mellitus (DM), hypertension (HP) and dyslipidemia (DLP) and also a history of prostate neoplasia treated 15 years ago. It was previously treated four months ago receiving PCI of anterior descending artery, diagonal branch (bifurcation) and circumflex artery, with implantation of three drug-eluting stents. Lower limbs without edema, free calves. Currently admitted in the hemodynamics service for treatment of one stable atherosclerotic lesion (>70%) in right coronary artery. In regular use of medications prescribed by his cardiologist (AAS©, Jardiance©, Amiodarone, Clopidogrel, Exforge HC©, ciprofibrate).

Patient 2 has a history of ischemic cardiopathy, having previously performed (seven months ago) implants of drug-eluting stents in the posterior descending artery and diagonal branch, with complaint of chest pain to the efforts that got better with adjustment of medication. Asthma and smoking, HP, DLP. Lower limbs without edema, free calves. Currently admitted in the hemodynamics service for treatment of one stable atherosclerotic lesion (>70%) in the diagonal branch. In use of the following medications (Effient©, Aradois©, Selozok©, rosuvastatin, Somalgin Cardio©, Vastarel©, Lipless©, Procoralan©).

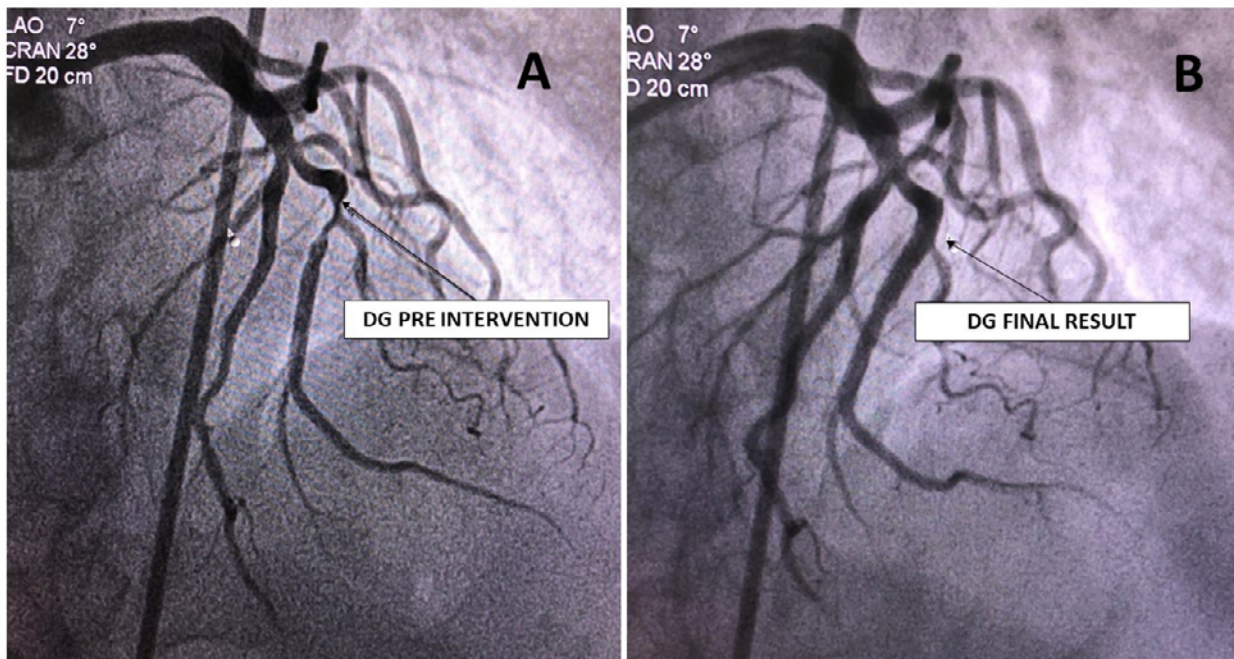
### Results

Angiographic results of both patients are shown in Figures 4 and 5, which illustrate the vessels treated pre and post procedure for implanting drug-eluting stents. Both patients tolerated the five-minute walk and were released from the hospital after six hours, wandering uneventfully. None of the patients presented cardiac enzyme alterations or electrocardiogram alterations after the procedure. Patient 1 had no complaints related to the procedure or to ambulation, immediately during hospitalization or by phone the next day. Patient 2 reported low-intensity headache during hospitalization. The same patient reported low-intensity pain at the puncture site the next day. There were no clinically relevant changes in cardiovascular or ventilatory parameters during the six hours postoperative hospitalization or during ambulation. Both patients remained eupneic. Cardiovascular and oxyhemoglobin saturation behaviors in the pre and 6-hours postoperative period are displayed in table 2. The painful symptoms of patient 2 were treated with sodium dipyrone, with remission of symptoms. Patients were discharged from the hospital with double antiplatelet medication, made with acetylsalicylic acid and clopidogrel.

**Figure 4.** Angiography evidencing right coronary artery (RCA) pré (A) and post intervention (B) in patient 1



**Figure 5.** Angiography evidencing diagonal branch (DG) pré (A) and post intervention (B) in patient 2



**Table 2.** Cardiovascular and oxyhemoglobin saturation behaviors in the pre and 6-hours postoperative period

	HR		SBP		DBP		SatO2	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
<i>Patient 1</i>	71	65	128	121	76	70	94	93
<i>Patient 2</i>	68	69	110	114	60	79	93	95

HR = heart rate (beats/minute); SBP = systolic blood pressure (mmHg); DBP= diastolic blood pressure (mmHg); SatO2= oxyhemoglobin saturation (%).

## Discussion

As far as the authors of this study are aware, this is the first published study, even though it is in the form of a report of two cases, which proposes to investigate the physiotherapeutic intervention so early after a coronary angioplasty procedure, by prescription of ambulation after puncture performed in the femoral artery, associated with the use of VCDs. Coronary heart disease patients with symptoms such as angina, dyspnoea, and fatigue during exercise are regularly expected to engage in less exercise. This modification in usual levels of physical activity could be influenced by the psychological consequences of coronary heart disease itself, and also by professional and other advice given to the patient. It is well known that sedentary behavior may also partly reflect longstanding exercise patterns which anticipate the diagnosis of coronary heart disease, due to social, economic or cultural factors<sup>4</sup>.

The literature today makes it clear that regular exercise and greater physical fitness are associated with lower cardiovascular and total mortality, in patients with coronary heart disease<sup>5</sup>. This article aimed to present a possibility of creating into patients and assistant professionals a concept that exercise can be performed without risk, even in the early phase (hours) after a coronary intervention, also helping the patient to adopt a cardiovascular rehabilitation program and a healthy lifestyle after hospital discharge, since performing exercise shortly after PCI, even a low-intensity walk, creates into patients the concept that the exercise is not contraindicated and specially presents no risk, if well indicated and prescribed.

Considering the use of VCDs our case reports could not find any significant complications in the puncture

site related to ambulation, despite the pain sensation referred for one of the studied patients. Ketterle et al reported in 2015, in a sample of 161 patients, an incidence of complications after 24 hours from the PCI and VCDs use<sup>2</sup>. In fact, 5.6 % of the patients in the Angio-Seal© group faced situations like hematomas > 5 cm, pain or false aneurysms. In a meta-analysis of 12,937 patients the use of VCDs was scrutinized, reporting complication rates of 2.4 % after PCI and VCDs adoption<sup>6</sup>.

Another important aspect of the VCDs use is its association with pain in some studies<sup>2,7</sup>. Nowadays, lower levels of anesthesia are applied generally. With decreasing levels of local anesthesia, depending on the complexity of the intervention and therefore the length of the procedure, increasing pain levels with the use of VCDs are reported, since in a minority of procedures the local anesthesia is administered twice. In fact, the CLOSE-UP Pain Study reported higher pain levels in the puncture sites in patients treated with VCDs than in those treated conventionally, with manual compression<sup>7</sup>. This fact could explain the alleged pain referred by the patient in our study.

Again, considering the difficulty encountered by many physiotherapists in working with patients admitted to the hospital for hemodynamic procedures, often by the physician himself, who is not accustomed to having cardiovascular rehabilitation in this population, for fear of bleeding at the arterial puncture site, for example. Articles such as the one presented here are important to show the professionals involved in the assistance after angioplasty procedures, which, in knowing how VCDs work, even in patients with femoral arterial puncture, it is possible to insert the cardiovascular physiotherapist in the first hours after the procedure, prescribing exercise and helping the patient in his healing process.

This study, because it deals with only two cases, has significant limitations that should be pointed out. Clearly if there are more cases, complications could arise and it should not be assumed that early ambulation in this population is risk free. Another point is related to the non-performance of ultrasound examinations, which could point to the formation of pseudoaneurysms in the region of the femoral artery puncture. A third aspect is related to the non-measurement of pain intensity reported by the patient in our study, using a visual analogue scale, for example. It is important that the physiotherapist uses scales that quantify parameters such as pain, in order to measure whether the proposed treatment is efficient in reducing the pain.

## Conclusion

Early ambulation within six hours after PCI was well tolerated in the two cases studied, even with the femoral artery access site. The use of a mechanical device for arterial closure was important so that the ambulation could be carried out in this population.

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## Author contributions

Gardenghi G was responsible for the study conception and design, data collection and writing of the manuscript. Magalhães FGS and Fernandes FH were responsible for data collection, project conception and revision of the manuscript. Araújo AG was responsible for data collection and revision of the manuscript. Nery MW was responsible for the review of the manuscript. Barbosa FP and Moraes Júnior AM were responsible for data collection and revision of the manuscript. Prudente ML was responsible for the study conception and design and writing of the manuscript.

## Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

## References

1. Rassaf T, Steiner S, Kelm M. Postoperative care and follow-up after coronary stenting. *Dtsch Arztebl Int.* 2013;110(5):72-82. doi: [10.3238/arztebl.2013.0072](https://doi.org/10.3238/arztebl.2013.0072)
2. Ketterle J, Rittger H, Helmig I, Klinghammer L, Zimmermann S, Hohenforst-Schmidt W et al. Comparison of Exo-Seal® and Angio-Seal® for arterial puncture site closure. A randomized, multicenter, single-blind trial. *Herz.* 2015;40(5):809-816. doi: [10.1007/s00059-015-4306-3](https://doi.org/10.1007/s00059-015-4306-3)
3. Fanzani A, Conraads VM, Penna F, Martinet W. Molecular and cellular mechanisms of skeletal muscle atrophy: an update. *J Cachexia Sarcopenia Muscle.* 2012;3(3):163-79. doi: [10.1007/s13539-012-0074-6](https://doi.org/10.1007/s13539-012-0074-6)
4. Stewart R, Held C, Brown R, Vedin O, Hagstrom E, Lonn E et al. Physical activity in patients with stable coronary heart disease: an international perspective. *Eur Heart J.* 2013;34(42):3286-93. doi: [10.1093/eurheartj/ehz258](https://doi.org/10.1093/eurheartj/ehz258)
5. Kavanagh T, Mertens DJ, Hamm LF, Beyene J, Kennedy J, Corey P et al. Prediction of long-term prognosis in 12 169 men referred for cardiac rehabilitation. *Circulation.* 2002;106(6):666-671.
6. Arora N, Matheny ME, Sepke C, Resnic FS. A propensity analysis of the risk of vascular complications after cardiac catheterization procedures with the use of vascular closure devices. *Am Heart J.* 2007;153(4):606-611. doi: [10.1016/j.ahj.2006.12.014](https://doi.org/10.1016/j.ahj.2006.12.014)
7. Sindberg B, Schou M, Hansen L, Christiansen KJ, Jørgensen KS, Sóltoft M et al. Pain and discomfort in closure of femoral access coronary angiography. The CLOSuredEvices used in everyday practice (CLOSE-UP) pain sub study. *Eur J Cardiovasc Nurs.* 2014;13(3):221-226. doi: [10.1177/1474515113482809](https://doi.org/10.1177/1474515113482809)