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Intravascular ultrasound in percutaneous coronary intervention guidance: results from Portuguese registry

Ultrassonografia intravascular para guiar a intervenção coronária percutânea: resultados do registro nacional português

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ABSTRACT - **Background**: Current guidelines recommend the use of coronary intravascular ultrasound as an adjunctive tool in challenging situations. **Objective**: To characterize the use of intravascular ultrasound in Portugal and compare outcomes after left main percutaneous coronary intervention, with or without intravascular ultrasound. **Methods**: A retrospective multicentric observational study analyzed patients who underwent percutaneous coronary intervention between January 2012 and December 2018 and were included in the Portuguese Registry on Interventional Cardiology of the *Sociedade Portuguesa de Cardiologia*. A two-sided p-value<0.05 was considered statistically significant. **Results**: This study revealed significant variation of intravascular ultrasound usage in Portugal over time (p-value Chi-squared for trend <0.001). The year with maximum use was 2016 (2.4%). Regarding left main percutaneous coronary intervention, there was a progressive increase in use of intravascular ultrasound (p-value Chi-squared for trend<0.001) in the last 7 years, with important regional differences. The population submitted to left main percutaneous coronary intervention with intravascular ultrasound was younger, but had a higher prevalence of some cardiovascular risk factors, ventricular systolic dysfunction, and complex coronary lesions. Moreover, this group of patients had lower prevalence of intrahospital primary endpoint (1.4% *versus* 3.9%; p=0.024). However, after multivariate analysis adjusted to confounding factors, this study did not demonstrate a significant impact of intravascular ultrasound on intrahospital endpoint. **Conclusion**: The overall use of intravascular ultrasound in left main percutaneous coronary intervention has been slowly increasing in the last seven years, in Portugal. In this study, the use of this method had no statistical impact in intrahospital endpoints.

Keywords: Ultrasonography, interventional; Cardiovascular diseases; Risk factors; Percutaneous coronary intervention; Portugal

RESUMO - **Introdução:** As diretrizes atuais recomendam o uso da ultrassonografia intravascular de coronárias como ferramenta adjuvante em situações difíceis. **Objetivo**: Caracterizar a utilização da ultrassonografia intravascular em Portugal e comparar os desfechos após intervenção coronária percutânea no tronco da coronária esquerda, guiada ou não por ultrassonografia intravascular. **Métodos**: Estudo observacional retrospectivo multicêntrico, que analisou pacientes submetidos à intervenção coronária percutânea entre janeiro de 2012 e dezembro de 2018, incluídos no Portuguese *Registry on Interventional Cardiology* da Sociedade Portuguesa de Cardiologia. Valor de p bicaudal <0,05 foi considerado estatisticamente significativo. **Resultados:** Este estudo demonstrou variação significativa na utilização da ultrassonografia intravascular em Portugal (valor de p qui-quadrado para tendência <0,001). O ano com maior utilização foi 2016 (2,4%). Houve aumento progressivo, nos últimos 7 anos, na utilização da ultrassonografia intravascular na intervenção coronária percutânea do tronco da coronária esquerda (valor de p qui-quadrado para tendência <0,001), com importantes diferenças regionais. A população submetida à intervenção coronária percutânea

do tronco da coronária esquerda guiada por ultrassonografia intravascular era mais jovem, mas tinha maior prevalência de fatores de risco cardiovascular, disfunção sistólica ventricular e lesões coronárias complexas. Além disso, esse grupo de pacientes teve menor prevalência do desfecho primário intra-hospitalar (1,4% *versus* 3,9%; p=0,024). Porém, após análise multivariada ajustada para fatores de confusão, este estudo não demonstrou impacto significativo da utilização da ultrassonografia intravascular no desfecho intra-hospitalar. **Conclusão:** A utilização da ultrassonografia intravascular na intervenção coronária percutânea do tronco da coronária esquerda vem aumentando lentamente nos últimos 7 anos em Portugal. Neste estudo, a utilização desse método não teve impacto estatístico nos desfechos intra-hospitalares.

Descritores: Ultrassonografia de intervenção; Doenças cardiovasculares; Fatores de risco; Intervenção coronária percutânea; Portugal

INTRODUCTION

Coronary intravascular ultrasound (IVUS) was the first coronary imaging technique to be developed and is an ultrasound-based imaging modality.[1]

Intravascular ultrasound can provide information about the extent and severity of the disease, lesion morphology and mechanism of stent failure.[2] In addition, it can guide stent implantation and evaluate periprocedural complications.

Complications due to this technique are uncommon (<1%),[3] although in small (<1.5mm of diameter) and tortuous vessels additional care is important.

Coronary angiography is the gold standard to evaluate coronary artery disease, but it has important limitations. Current knowledge supports the use of IVUS as an adjunctive tool in challenging situations, as left main coronary artery (LMCA) disease,[4] long lesions,[5] chronic total occlusion,[6] and complex bifurcation lesions.[7] Furthermore, the ULTIMATE Trial[8] revealed clinical benefits associated with IVUS guidance extend to every all-comer patient undergoing second-generation drug-eluting stent implantation. The IVUS optimization targets include: 90% expansion cut-off; complete stent apposition; no proximal stent deformation; stent edges with less than 40% of plaque burden; and absence of dissection.[9]

The current European Society of Cardiology (ESC) guidelines on myocardial revascularization (2018) support the use of IVUS, with a class of recommendation IIa and a level of evidence B, in selected patients to optimize stent implantation, to assess severity and optimize treatment of unprotected LMCA lesions. In addition, a class of recommendation IIa and a level of evidence C support the use of IVUS to detect stent-related mechanical problems leading to restenosis.[10] Despite the similarities between 2018 and 2014 ESC guidelines, the use of intracoronary imaging to guide percutaneous coronary intervention (PCI) is heterogeneously distributed across the world. In Europe it is still just used in less than 20% of PCI,[1] however, in Japan, it is used in 84.8% of PCI.[11]

This study aims to characterize the use of IVUS in the last seven years in Portugal, and to evaluate if there are regional differences across the country. Furthermore, it is designed to characterize the population undergoing LMCA PCI, and compare intrahospital outcomes after LMCA PCI guided by either IVUS or angiography.

METHODS

Population

A retrospective multicentric observational study was performed based on the Portuguese Registry on Interventional Cardiology (Pric).

This voluntary registry includes 25 portuguese interventional cardiology centers, is coordinated by *Associação Portuguesa de Intervenção Cardiovascular* (Apic), and meets the requirements of the Cardiology Audit and Registration Data Standards (Cards) defined by the ESC.

Study groups

This study evaluated all patients who underwent PCI in Portugal between January 2012 and December 2018, and were included in the RNCI. Percutaneous coronary interventions with no information about the use of IVUS were excluded.

This study divided Portugal into four regions (Region 1 to 4) to compare regional differences across the country regarding the usage trend of IVUS in total PCI and LMCA PCI.

The clinical and angiographic profiles of patients who underwent PCI, guided or not by IVUS, were characterized and compared. Furthermore, this characterization was also performed on LMCA PCI patients.

Outcomes

The intrahospital primary endpoint was a composite of all-cause death and myocardial infarction (MI). The definition of MI denotes the presence of acute myocardial injury detected by abnormal cardiac biomarkers, in the setting of evidence of acute myocardial ischemia.

Other clinical intrahospital endpoints were MI, all-cause death, stroke and intrahospital major bleeding. The definition of intrahospital major bleeding includes patients with intracranial hemorrhage or at least a 5g/dL decrease in hemoglobin concentration, or at least 15% absolute decrease in hematocrit.

The completion rate on the reporting of complications during the hospitalization was 77%.

Statistical analysis

Continuous variables were tested for normality using Shapiro-wilks test.

All continuous variables followed a Gaussian distribution and were expressed as mean ± standard deviation (SD) and were compared using unpaired Student's *t*-test. Categorical variables were expressed as count and percentage (%)

and were compared using Chi-squared test or Fisher exact test, if a cell value was less than 5.

The Chi-squared for trend was used to evaluate the tendency to increase the use of IVUS during the last 7 years.

Logistic regression was calculated to evaluate the impact of IVUS in intrahospital primary endpoint.

A two-sided p-value <0.05 was considered statistically significant. A 95%CI was used. All analyses were performed using the IBM Statistical Package for the Social Sciences (SPSS) version 19.0(IBM SPSS Inc., Chicago, IL).

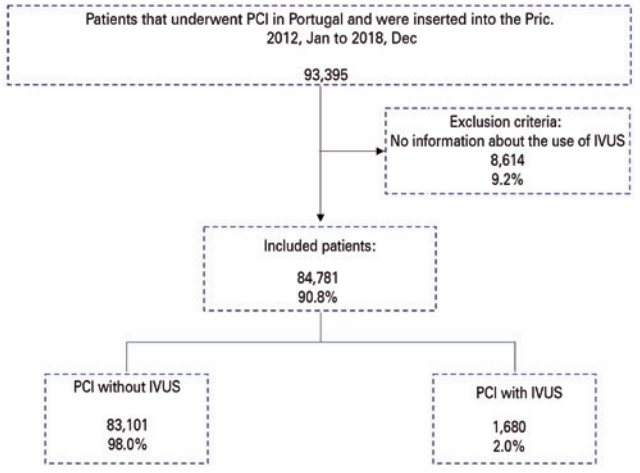
RESULTS

Coronary intravascular ultrasound usage in percutaneous coronary intervention

In Portugal, between January 2012 and December 2018, 93,395 PCI were performed and inserted into the RNCI, of which 84,781 (90.8%) had information about the use of IVUS and were included in this study. Of the 84,781 PCI analyzed, IVUS was only used in 1,680 (2.0%) (Figure 1).

This study revealed significant variation of IVUS usage in Portugal over time (p-value Chi-squared for trend <0.001). Figure 2 shows a fall between 2012 and 2014, a rise from 2014 to 2016, and a second fall until 2018. The year with maximum use of IVUS was 2016 (2.4%) and the year with the minimum use was 2014 (1.5%).

Additionally, Portugal was divided into four regions and regional differences regarding the usage trend of IVUS in PCI were detected. Figure 3 shows the four regions, the numbers of centers included per region, total population, and population density coverage per region.



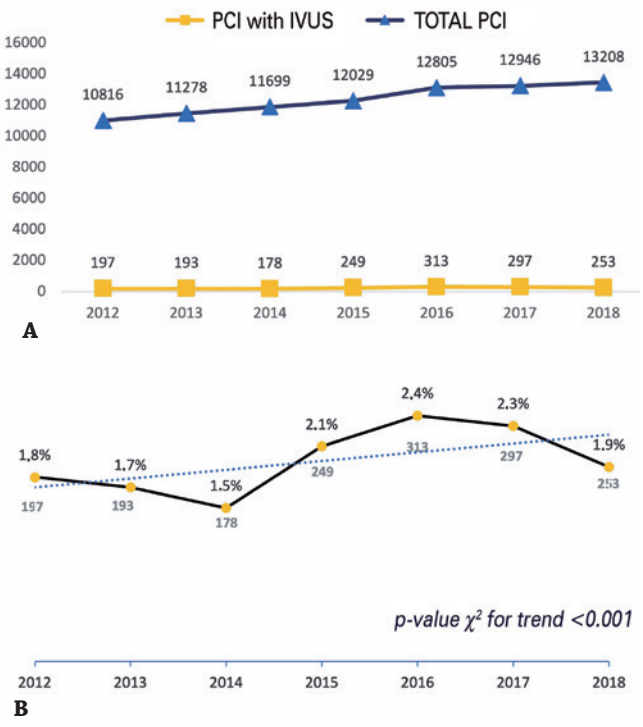
PCI: percutaneous coronary intervention; Pric: Portuguese Registry on Interventional Cardiology; IVUS: intravascular ultrasound.
Figure 1. Flowchart of study population.

This study revealed that in Regions 1 and 2 there were also significant variations over time (Region 1: p-value Chi-squared for trend <0.001; Region 2: p-value Chi-squared for trend < 0.033). In both regions was observed a fall between 2012 and 2014, a rise from 2014 to 2017, and a second fall until 2018. However, in Region 3 and 4 no significant variations were detected.

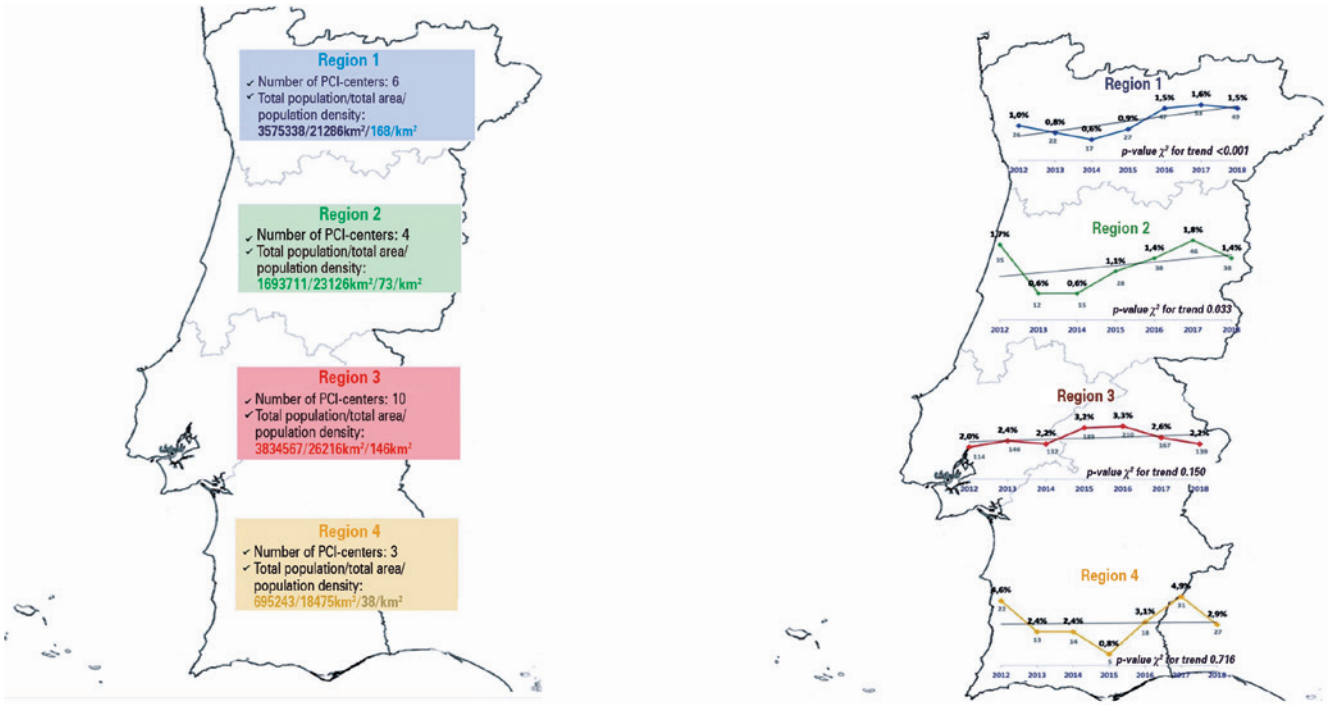
Considering the clinical presentation, this study showed that 38.1% of IVUS usage occurred in acute coronary syndromes (ACS); in other words, 57.4% occurred in elective conditions (Figure 4).

This study also compared the clinical and angiographic profiles of patients who underwent PCI, with and without IVUS (Table 1). In this sub-analysis, PCI without information about LMCA treatment were also excluded.

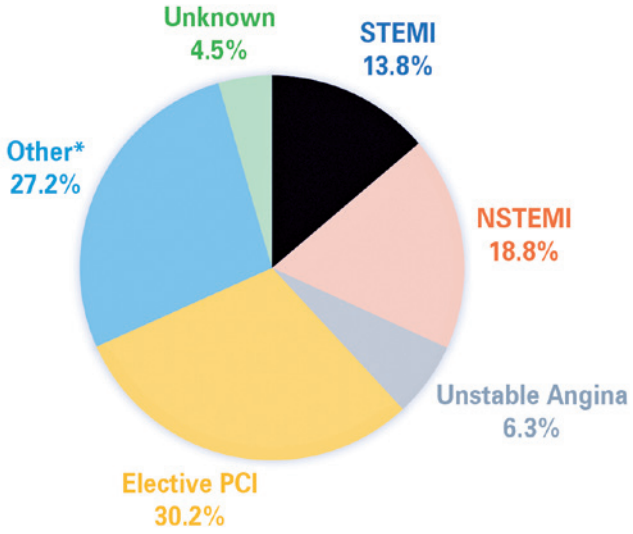
The group of patients who underwent PCI, with and without IVUS, had similar distribution per sex. Nevertheless, patients in the IVUS group were younger and had a higher prevalence of cardiovascular risk factors [hypertension (73.8% *versus* 65.6%), diabetes mellitus (34.5% *versus* 29.4%), dyslipidemia (66.2% *versus* 54.9%) and smoking habits (45.8% *versus* 36.2%)] and cardiovascular comor-



PCI: percutaneous coronary intervention; IVUS: intravascular ultrasound.
Figure 2. Temporal evolution from 2012 to 2018 of total percutaneous coronary intervention with and without intravascular ultrasounds: absolute (A) and relative (B) frequency.



PCI: percutaneous coronary intervention.
Figure 3. Division of Portugal into four regions and usage trend of intravascular ultrasounds in percutaneous coronary intervention in Portugal per region.



*Other: arrythmia, valvular disease, myocardiopathy, heart failure.
STEMI: ST segment elevation myocardial infarction; NSTEMI: non-ST segment elevation myocardial infarction; PCI: percutaneous coronary intervention.
Figure 4. Reasons to use intravascular ultrasound during percutaneous coronary intervention.

bidities [cerebrovascular disease (6.1% *versus* 4.8%), previous MI (29.6% *versus* 19.7%), previous PCI (40.6% *versus* 25.1%), previous coronary artery bypass grafting (CABG) (9.0% *versus* 5.7%), heart failure (6.4% *versus* 3.5%), peripheral artery disease (6.3% *versus* 3.9%) and chronic kidney disease (9.9% *versus* 6%)]. In addition, they also had a higher prevalence of left ventricular systolic dysfunction with ejection fraction <50% (17.2% *versus* 11%).

Considering angiographic characteristics, patients who underwent PCI with IVUS had a higher prevalence of multivessel disease (69.1% *versus* 58%), and complex coronary lesions [C-type lesion (40.5% *versus* 32.6%), in-stent restenosis (5.8% *versus* 3.6%) and coronary bifurcation lesion (8.9% *versus* 6.5%)].

Coronary intravascular ultrasound usage in left main percutaneous coronary intervention

In this study, 2,462 patients submitted to LMCA PCI were analyzed, and 2,222 of them (90.3%) had information about the use of IVUS and were included.

Out of the 2,222 LMCA PCI analyzed, IVUS was used in 405 (18.2%).

Table 1. Clinical and angiographic characteristics of patients who underwent percutaneous coronary intervention, with and without intravascular ultrasound

Clinical characteristics	PCI without IVUS (n=73,435; 97,9)	PCI with IVUS (n=1,597; 2.1%)	p-value
Age, years	66.3±11.7	65.4±11.8	0.001
Male gender	54.741 (74.5)	1.188 (74.4)	0.424
BMI, kg/m²	27.6±4.2	27.7±4.3	0.424
Hypertension	48.156 (65.6)	1.179 (73.8)	<0.001
Diabetes mellitus	21.600 (29.4)	551 (34.5)	<0.001
Dyslipidemia	40.340 (54.9)	1.057 (66.2)	<0.001
Smoking habit	26.582 (36.2)	732 (45.8)	<0.001
Cerebrovascular disease	3.516 (4.8)	98 (6.1)	0.13
Previous MI	14.635 (19.9)	472 (29.6)	<0.001
Heart failure	2.567 (3.5)	103 (6.4)	<0.001
Peripheral artery disease	2.900 (3.9)	100 (6.3)	<0.001
Chronic kidney disease	4.427 (6.0)	158 (9.9)	<0.001
Previous PCI	18.423 (25.1)	648 (40.6)	<0.001
CABG	4.214 (5.7)	143 (9.0)	<0.001
Ejection fraction <50%	8.084 (11.0)	274 (17.2)	<0.001
Angiographic characteristics			
Number of vessels disease			
1	27.658 (37.7)	450 (28.2)	<0.001
2	24.438 (33.3)	596 (37.3)	
3	18.191 (24.8)	508 (31.8)	
Unknown	3.148 (4.3)	43 (2.7)	
Multivessel disease	42.629 (58.0)	1.104 (69.1)	<0.001
Vessels treated			
Left main	1.817 (2.5)	405 (25.4)	<0.001
LAD artery	33.302 (45.3)	789 (49.4)	0.001
Cx artery	20.492 (27.9)	444 (27.8)	0.928
RC artery	27.331 (37.2)	502 (31.4)	<0.001
Bypass	853 (1.2)	10 (0.6)	0.047
Number of lesions treated			
1	49.312 (67.2)	778 (48.7)	
2	17.638 (24.0)	440 (27.6)	<0.001
3	4.990 (6.8)	263 (16.5)	
4	1.495 (2.0)	116 (7.3)	
Total of lesions	105.538	2.911	
Lesion type			
A	6.262 (6.1)	69 (2.4)	
B	56.583 (54.8)	1.413 (48.8)	<0.001
C	33.656 (32.6)	1.172 (40.5)	
Unknown	6.663 (6.5)	241 (8.3)	
In-stent restenosis	3.682 (3.6)	169 (5.8)	<0.001
Coronary bifurcation lesion	6.627 (6.5)	258 (8.9)	<0.001

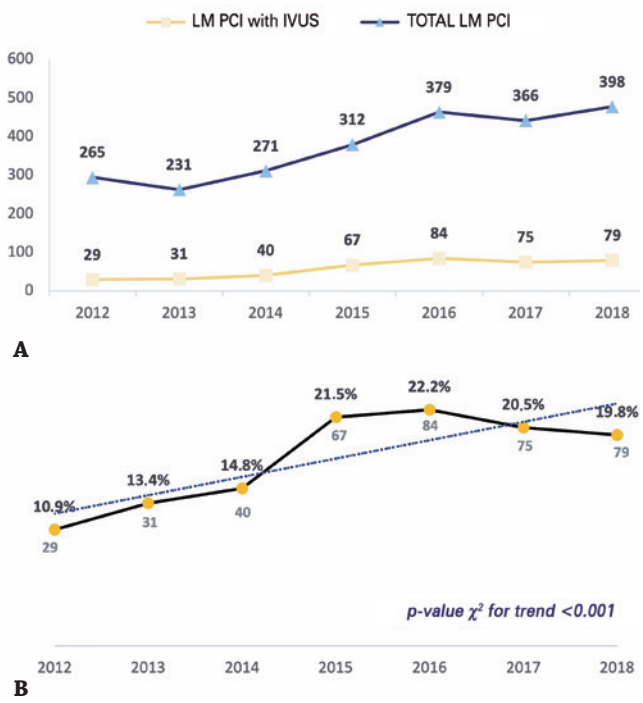
Results expressed as mean ± standard deviation or n (%).
PCI: percutaneous coronary intervention; IVUS: intravascular ultrasound; BMI: body mass index; CABG: coronary artery bypass grafting; MI: myocardial infarction; LAD: left anterior descending artery; Cx: circumflex artery; RC: right coronary artery.

This study revealed a progressive increased use of IVUS in LMCA PCI in Portugal, between 2012 and 2018 (p-value Chi-squared for trend <0.001) (Figure 5). The year with maximum use of IVUS was 2016 (22.2%) and the year with the minimum use was 2012 (10.9%).

After analysis of the four regions, regional differences were also detected (Figure 6). In Regions 1 and 4 was observed a trend to increase the use of IVUS in LMCA PCI (Region 1: p-value Chi-squared for trend <0.001; Region 4: *p-value* Chi-squared for trend <0.001), which was not observed in Regions 2 and 3.

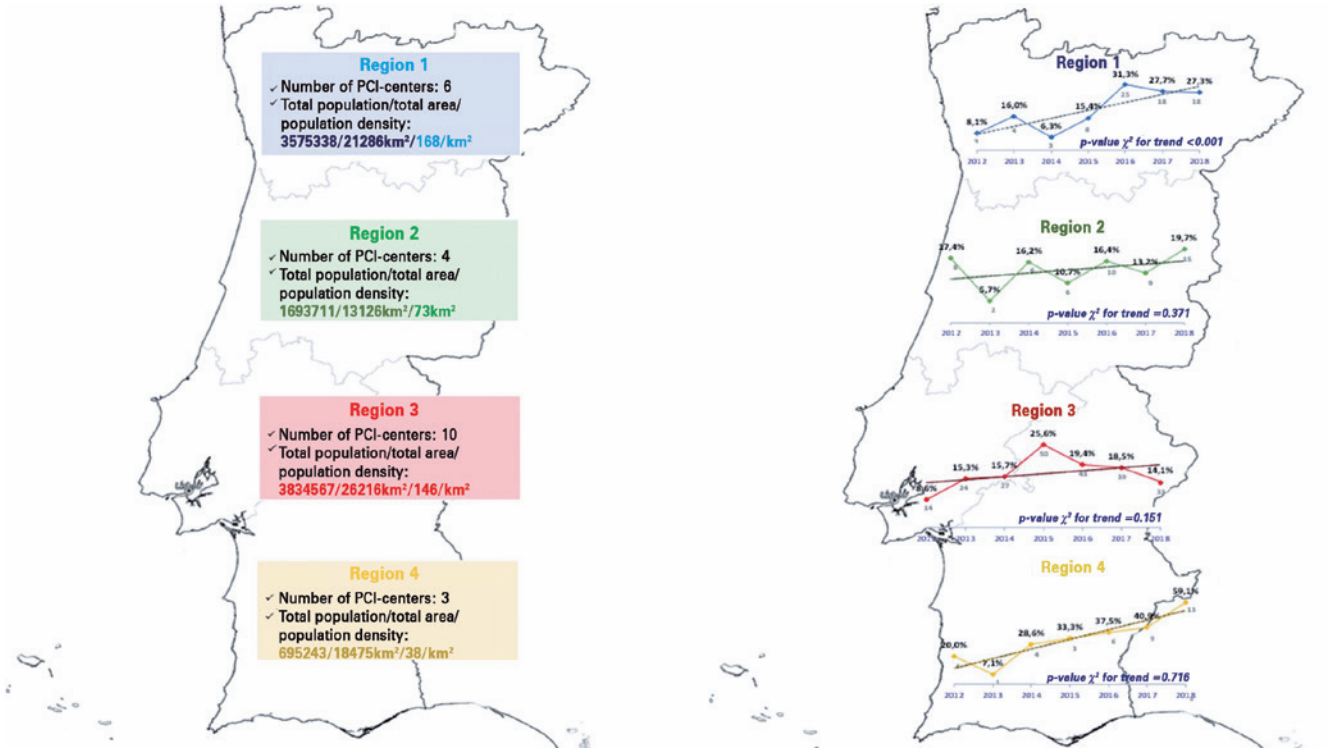
Regarding the clinical presentation, 36.2% of IVUS usage occurred in ACS and 56.3% in elective conditions (Figure 7).

The group of patients who underwent LM PCI (Table 2), with and without IVUS, had similar sex distribution, nonetheless patients from the IVUS group were younger, had a higher prevalence of some cardiovascular risk factors [hypertension (75.6% *versus* 70.0%), dyslipidemia (67.2% *versus* 60.9%) and smoking habit (39.5% *versus* 28.2%)], a higher prevalence of previous PCI (33.8% *versus* 28.6%)

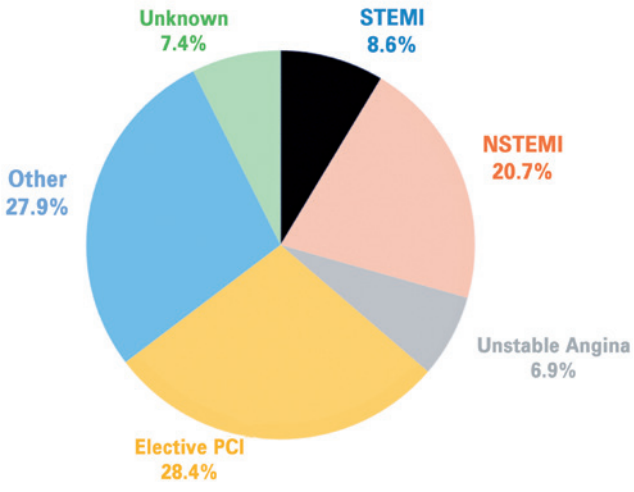


LMCA: left main coronary artery; PCI: percutaneous coronary intervention; IVUS: intravascular ultrasound.

Figure 5. Temporal evolution from 2012 to 2018 of the left main percutaneous coronary intervention with and without intravascular ultrasounds; absolute (A) and relative (B) frequency.



PCI: percutaneous coronary intervention.
Figure 6. Division of Portugal into four regions and usage trend of intravascular ultrasounds in left main percutaneous coronary intervention in Portugal per region.



*Other: arrythmia, valvular disease, myocardiopathy, heart failure.
STEMI: ST-segment elevation myocardial infarction; NSTEMI: non-ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention.
Figure 7. Reasons to use intravascular ultrasound during left main percutaneous coronary intervention.

and ejection fraction under 50% (21.5% *versus* 17.2%). Still, they had a lower prevalence of previous CABG (18.5% *versus* 25.8%).

Considering angiographic characteristics, patients who underwent LM PCI with IVUS had more complex coronary lesions [C-type lesion (35.1 *versus* 28.6%) and coronary bifurcation lesion (11.5% *versus* 18%)].

Coronary intravascular ultrasound: impact on left main percutaneous coronary intervention outcomes

This study revealed that patients who underwent LM PCI, with and without IVUS, had similar periprocedural and intrahospital complications, even though patients from the IVUS group had a lower prevalence of intrahospital primary endpoint (a composite of all-cause death and MI; 1.4% *versus* 3.9%) and all-cause death (0.9% *versus* 3.8%) (Table 3).

After a multivariate analysis adjusted to confounding factors, this study did not demonstrate a significant impact of IVUS on the intrahospital primary endpoint (OR: 1.7; p-value=0.310; CI95% 0.6-4.8).

Table 2. Clinical and angiographic characteristics of patients who underwent left main percutaneous coronary intervention, with and without intravascular ultrasound

Clinical characteristics	PCI without IVUS (n=1.817; 81.9%)	PCI with IVUS (n=405; 18.2%)	p-value
Age, years	70.1±11.2	67.9±11.7	<0.001
Male gender	1.326 (73.0)	298 (73.6)	0.805
BMI, kg/m^2	27.3±4.3	27.2±4.0	0.880
Hypertension	1.271 (70.0)	306 (75.6)	0.025
Diabetes mellitus	665 (36.6)	164 (40.5)	0.051
Dyslipidemia	1.107 (60.9)	272 (67.2)	0.019
Smoking habit	512 (28.2)	160 (39.5)	<0.001
Cerebrovascular disease	146 (8.0)	38 (9.4)	0.374
Previous MI	517 (28.5)	116 (28.6)	0.939
Heart failure	141 (7.8)	39 (9.6)	0.212
Peripheral artery disease	166 (9.1)	33 (8.1)	0.529
Chronic kidney disease	210 (11.6)	55 (13.6)	0.256
Previous PCI	519 (28.6)	137 (33.8)	0.036
CABG	468 (25.8)	75 (18.5)	0.002
Ejection fraction <50%	312 (17.2)	87 (21.5)	0.041
Angiographic characteristics			
Number of vessels disease			
1	51 (2.8)	19 (4.7)	<0.001
2	725 (39.9)	192 (47.4)	
3	904 (49.8)	181 (44.7)	
Unknown	137 (7.5)	13 (3.2)	
Multivessel disease	1.629 (89.7)	373 (92.1)	0.136
Vessels with disease in addition to LMCA			
LAD artery	1.227 (67.5)	280 (69.1)	0.531
Cx artery	1.101 (60.6)	243 (60.0)	0.825
RC artery	937 (51.6)	192 (47.4)	0.130
Vessels treated in addition to LMCA			
LAD artery	678 (37.3)	165 (40.7)	0.199
Cx artery	603 (33.2)	146 (36.0)	0.270
RC artery	153 (8.4)	311 (7.7)	0.613
Bypass	13 (0.7)	1 (0.2)	0.487
Number of lesions treated			
1	681 (37.5)	145 (35.8)	
2	627 (34.5)	127 (31.4)	0.101
3	355 (19.5)	84 (20.7)	
4	154 (8.5)	49 (12.1)	
Total of lesions	3616	847	
Lesion type			
A	84 (2.3)	10 (1.2)	
B	2.169 (60.4)	465 (55.0)	0.001
C	1.028 (28.6)	297 (35.1)	
Unknown	313 (8.7)	74 (8.7)	
In-stent restenosis	131 (3.7)	30 (3.5)	0.872
Coronary bifurcation lesion	410 (11.5)	152 (18.0)	<0.001

Results expressed as mean ± standard deviation or n (%).
PCI: percutaneous coronary intervention; IVUS: intravascular ultrasound; BMI: body mass index; MI: myocardial infarction; CABG: coronary artery bypass grafting; LAD: left anterior descending artery; Cx: circumflex artery; RC: right coronary artery.

Table 3. Periprocedural complications and complications during the hospitalization of patients who underwent left main coronary artery percutaneous coronary intervention, with and without intravascular ultrasound

Periprocedural complications	LMCA PCI without IVUS (n=1.817; 81.9%)	LMCA PCI with IVUS (n=405; 18.2%)	p-value
Acute occlusion of the lesion	11 (0.6)	3 (0.8)	0.715
Slow-flow	11 (0.6)	0	0.229
Cardiorespiratory arrest	45 (2.5)	4 (1.1)	0.112
Complications during hospitalization			
MI after PCI	1 (0.1)	2 (0.6)	0.076
Stroke after PCI	0	1 (0.3)	0.169
All-cause death after PCI	65 (3.8)	3 (0.9)	0.005
Major bleeding	5 (0.3)	0	0.596
Intrahospital primary endpoint	66 (3.9)	5 (1.4)	0.024

Results expressed as n (%).
LMCA: left main coronary artery; PCI: percutaneous coronary intervention; IVUS: intravascular ultrasound; MI: myocardial infarction; PCI: percutaneous coronary.

DISCUSSION

Currently, IVUS is used in 2% of PCI, which highlights the lower employment of this technique in Portugal, even when compared with Europe, where IVUS is used in 20% of PCI.[1]

The increased cost, absence of reimbursement, notion of apparent lack of benefit as operators may consider coronary angiography to be sufficient, time-related constrains, and the slow learning curve for execution and interpretation are possible explanations for the lower use in Portugal. Many studies have demonstrated the benefits of IVUS as an adjunctive tool, capable of overcoming the limitations of coronary angiography.

Two meta-analyses stand out: the first, published in 2016 by Elgendy et al.,[12] which included seven randomized trials comprising 3,192 patients, and concluded that IVUS-guided PCI reduced the risk of major adverse cardiovascular events (6.5 *versus* 10.3%; OR 0.6; p-value <0.001); and the second, published in 2019 by Gao et al.,[13] which included 9 randomized trials with a total of 4,724 patients, and determined that IVUS-guidance was associated with significant lower risk of major adverse cardiovascular events (5.4% *versus* 9.0%; OR 0.61; p-value <0.001).

Additionally, an Italian study published in 2015, by Alberti et al.,[14] examined the economic impact of IVUS and supported the cost-effectiveness of this strategy, namely due to the detection of complex patients who benefit from more accurate stent implantation.

In this study, the population submitted to PCI with IVUS had a higher prevalence of cardiovascular risk factors and comorbidities, previous CABG/PCI, ventricular systolic dysfunction, multivessel disease, and complex coronary lesions (C-type lesion, in-stent restenosis, and coronary bifurcation lesion). Therefore, the authors considered that in Portugal IVUS was used in more complex situations, whenever the additional information could be crucial to success.

This reality was supported by a meta-analysis published in 2017, by Bavishi et al.,[15] which included eight randomized trials with a total of 3,276 patients, and concluded that IVUS-guided PCI in complex coronary lesions was of greatest benefit in reducing the risk of major adverse cardiovascular events (6.5% *versus* 10.5; OR 0.6; p-value=0.001).

Nowadays, PCI has emerged as an acceptable revascularization strategy for selected patients with unprotected LM disease,[6,16,17] and current guidelines support the usage of IVUS to assess severity and guide treatment.[10]

Although the overall use of IVUS in LM PCI has been progressively increasing in the last seven years in Portugal, with important regional asymmetries, this study revealed that just 18.2% of LM PCI use IVUS, which is clearly insufficient as per the current recommendations.

The population submitted to LM PCI with IVUS was younger but had a higher prevalence of some cardiovascular risk factors, previous PCI, ventricular systolic dysfunction, and complex coronary lesions (C-type and coronary bifurcation lesion).

Current studies have shown some discrepancies in the impact of IVUS usage in LM PCI.

A meta-analysis published in 2017, by Ye et al.,[4] comprised nine non-randomized studies and one randomized study, with a total of 6,480 patients, and concluded IVUS-guided LM PCI significantly reduced the risk of all-cause death (OR 0.6; p-value<0.001); cardiac death (OR 0.5; p-value<0.001) and target lesion revascularization (TLR; OR 0.4; p-value=0.002). These results were supported by the EXCEL trial IVUS sub-study, presented at the Transcatheter Cardiovascular Therapeutics (TCT) 2016 conference, Washington, DC, USA, which demonstrated a significant reduction of major adverse cardiac events, all-cause and cardiac death, stent thrombosis, and MI with IVUS usage. On the other hand, NOBLE trial IVUS sub-study,[18] published in 2020, concluded that post-PCI IVUS was just associated with substantially less TLR.

Limitations

This study evaluated the usage and impact of IVUS in Portugal, although other intracoronary imaging techniques, namely optical coherence tomography, were not included, which could mask the true employment of intracoronary imaging in Portuguese cardiac catheterization laboratories. Additionally, no information regarding IVUS parameters related to outcomes (*e.g.*, stent expansion, minimal stent area, edge border dissection, and plaque burden) were available. Finally, there are limitations related to the fact that it was a retrospective study based on a voluntary national registry.

CONCLUSION

It is difficult to explain the discrepancy among studies; hence, larger and more powerful randomized trials are necessary to evaluate the true impact of intravascular ultrasounds on this subset of patients.

In most cases intravascular ultrasound is used in elective and complex conditions (clinical and angiographic).

In this study, there was not a statistical impact of left main percutaneous coronary intervention guided by intravascular ultrasound on intrahospital endpoints.

This study showed the low employment of intravascular ultrasound in Portugal and the regional asymmetries still present in this country. Considering the current knowledge, it is important to increase the use of this technique.

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CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: CMMPR and CGB; data collection: CMMPR, CGB, MC, PCS, RCF, RCT, JCS, FS, JC, HP, PPC and EIO; data interpretation: CMMPR; text writing: CMMPR; approval of the final version to be published: CMMPR, CGB, MC, PCS, RCF, RCT, JCS, FS, JC, HP, PPC and EIO.

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