



ORIGINAL ARTICLE

The TRACE registry (Trans-Radial Approach in Central and northErn Greece)



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Received 24 August 2015; accepted 29 September 2016

Available online 16 November 2016

KEYWORDS

Trans-femoral approach;
Coronary

Abstract *Objective:* We examined trans-radial approach (TRA) use in coronary angiographies (CAs) as well as in percutaneous coronary interventions (PCIs) in specific regions of Greece, its distribution in public and private catheterization laboratories (CLs) and its preference by operators. Reliable data regarding the use of TRA are not available in Greece.

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Peer review under responsibility of Hellenic Cardiological Society.

angiography;
Percutaneous
coronary
intervention;
Financial crisis

Methods: The study was performed in northern and central Greece, which constitutes 35.32% of the national population. This study focused on the years 2004, 2009 and 2013.

Results: There are 12 CLs. CAs performed using TRA were 0.43% in 2004, 12.28% in 2009 and 39.81% in 2013, whereas PCIs performed using TRA were 0.38%, 9.20% and 39.48%, respectively. Operators familiar with TRA, but who performed TRA electively, were 13.33% in 2004, 60.38% in 2009 and 42.37% in 2013. However, operators performing TRA routinely were 2.2%, 5.66%, and 49.15%, respectively. In 2013, there was a 3.76% decrease in CAs and 4.51% decrease in PCIs compared to 2009; in private CLs, there was a 29.63% decrease in CAs and 34.72% decrease in PCIs performed, which was contradictory to the 27.27% increase observed in CAs and 29.83% increase in PCIs in public CLs.

Conclusions: This is the first study to reveal the volumes and trends in interventions performed via TRA across central and northern Greece. TRA has gained a reputation among operators in both public and private CLs. Due to the financial crisis in Greece, catheterizations have been diminished, whereas private CLs have lost a great amount of their turnover.

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1. Introduction

Percutaneous trans-radial approach (TRA) for diagnostic coronary angiography (CA) was first described by Lucien Campeau in 1989,¹ and the first elective percutaneous coronary intervention (PCI) via TRA was performed in 1992 by Ferdinand Kiemeneij,² TRA is a part of the evolving landscape of interventional cardiology.³ Several reports have suggested that TRA for coronary angiography and intervention is equally effective in terms of procedural outcomes compared to trans-femoral approach (TFA) and permits a wide range of diagnostic and therapeutic interventions.⁴ Furthermore, TRA is a safe alternative to TFA due to its significantly lower rate of vascular entry site complications.^{5–7} In addition, TRA increases patient comfort and provides the opportunity for early discharge, taking into consideration that these patients frequently exhibit comorbidities, thereby reducing the cost of hospital stay.^{8–9}

Reliable data regarding the use of TRA are not currently available in Greece. The objective of the present study was to assess the use of TRA in both CA and PCI in central and northern Greece. In addition, we aimed to assess the familiarity of the approach to Greek operators and its frequency to both public and private units.

2. Methods

2.1. Study Protocol

This study was performed in central (Epirus, Thessaly) and northern (Macedonia, Thrace) Greece in both public and private hospitals, which utilized a catheterization laboratory (CL). A questionnaire regarding the use of TRA in CA and PCI was distributed from July to December 2013, whereas responses were collected from January to April 2014. All study participants provided their written informed consent and the institutional Review Committee approved the study.

The questionnaire addressed the total number of operators in each CL and the number of operators who routinely

used TRA (preferred method for all patients) or were familiarized with the method, but it was not their first choice (TFA was the preferred method and TRA was used electively). The questionnaire focused on the total number of CAs and PCIs performed in 2013, as well as 5 and 10 years before this specific time point (2009 and 2004, respectively). Moreover, there was an inquiry in the rate of TRA use in CAs and PCIs performed during these years. The collected data were evaluated independently for public and private units.

2.2. Statistical analysis

All variables were summarized as absolute counts and percentages.

3. Results

The total number of CLs in central and northern Greece were 12, in which the projected estimated population for 2013 by the Hellenic Statistical Authority was 3,906,900 individuals, constituting 35.32% of the national population. Within in this population, 8 CLs were public and 4 were private.

3.1. TRA in coronary angiographies

In 2004, 15,331 CAs were performed; 5,616 (36.63%) and 9,715 (63.37%) CAs were in public and private CLs, respectively. There has been an increase to 18,142 CAs in 2009 [8,246 (45.45%) were performed in public CLs and 9,896 (54.55%) in private CLs] and a slight decrease to 17,459 in 2013 [10,495 (60.11%) were performed in public CLs and 6,964 (39.89%) in private CLs]. Among these, only 66 CAs were performed via TRA (0.43%) in 2004, out of which 10 were performed in public CLs (0.18% of their volume and 0.07% of total volume) and 56 in private CLs (0.58% of their volume and 0.36% of total volume). In 2009, there were 2,227 (12.28%) CAs performed via TRA, out of which 69 were performed in public CLs (0.84% of their volume and 0.38% of

total volume) and 2,158 were performed in private CLs (21.81% of their volume and 11.90% of total volume). In 2013, there were 6,950 (39.81%) CAs performed using TRA, out of which 1,641 were performed in public CLs (15.64% of their volume and 9.40% of total volume) and 5,309 were performed in private CLs (76.23% of their volume and 30.41% of total volume) (Figures 1a & 2, Table 1).

3.2. TRA in percutaneous coronary interventions

In 2004, 5,028 PCIs were performed; 1,983 (39.44%) were performed in public CLs and 3,045 (60.56%) were performed in private CLs. There has been an increase to 6,848 in 2009 [3,205 (46.8%) were performed in public CLs and 3,643 (53.2%) in private CLs] and a slight decrease to 6,539 in 2013 [4,161 (63.63%) were performed in public CLs and 2,378 (36.37%) in private CLs]. Among these, only 19 PCIs on TRA (0.38%) were performed in 2004, out of which 2 were performed in public CLs (0.1% of their volume and 0.04% of total volume) and 17 were performed in private CLs (0.56% of their volume and 0.34% of total volume). Within the next

years, there was an exponential increase observed: 630 (9.20%) CAs in 2009, out of which 17 CAs were performed in public CLs (0.53% of their volume and 0.25% of total volume) and 613 CAs were performed in private CLs (16.83% of their volume and 8.95% of total volume). In addition, 2,582 (39.48%) CAs were performed in 2013, out of which 966 were performed in public CLs (23.22% of their volume and 14.77% of total volume) and 1,616 were performed in private CLs (67.96% of their volume and 24.71% of total volume) (Figures 1b & 2, Table 1).

3.3. TRA and interventional cardiologists

In 2004, 45 operators [27 in public (60%) and 18 in private CLs]. 3 (6.66% of operators in total) were familiarized with the method (TFA was the preferred method and TRA was used electively) and all of the operators performed in public CLs (11.11% of public CLs operators). Only one operator routinely used TRA in a private CL (preferred method for all patients) (2.2% of operators in total, 5.56% of operators in private CLs). In 2009, there were 53 operators

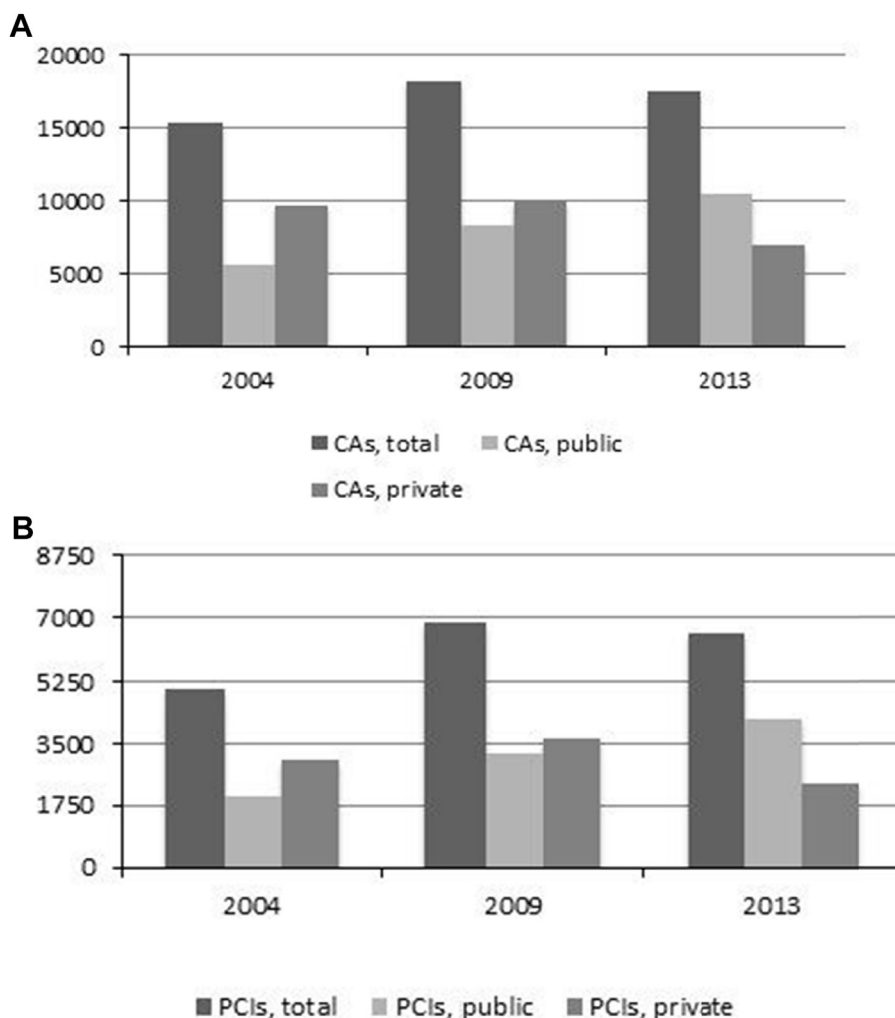


Figure 1 a. Absolute number of coronary angiographies (CAs) in total, in public catheterization laboratories (CLs) and private CLs. b. Absolute number of percutaneous coronary interventions (PCIs) in total, in public catheterization laboratories (CLs) and private CLs.

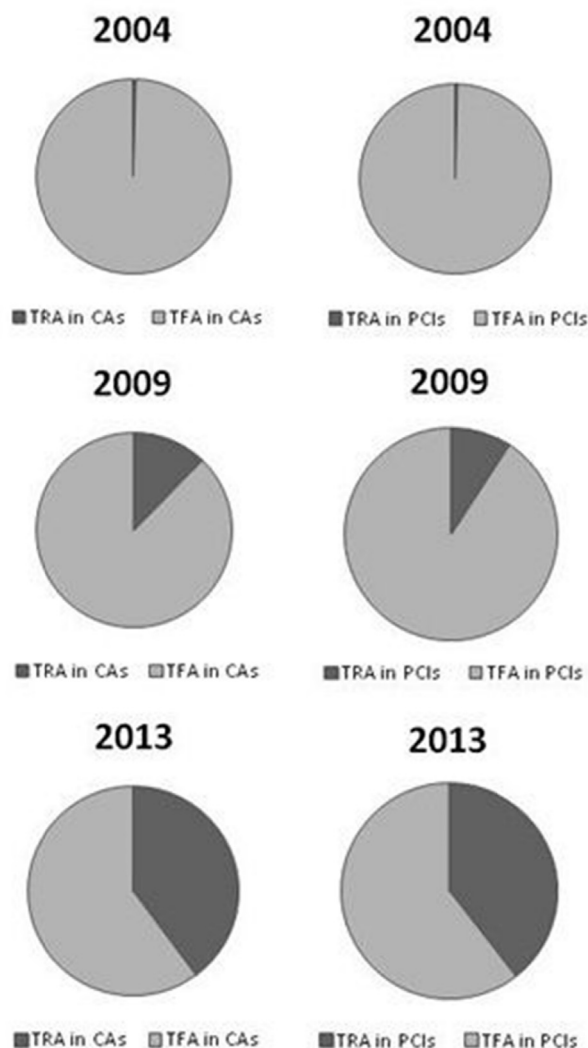


Figure 2 Rate of trans-radial (TRA) and trans-femoral (TFA) approach use in both coronary angiographies (CAs) and percutaneous coronary interventions (PCIs) performed from 2004 to 2013 in both public and private catheterization laboratories (CLs).

[32 in public CLs (60.3%)]. Twenty-four operators (45.28%) were familiarized with the method; of these operators, 10 performed in public CLs (31.25% of public CLs operators) and 14 performed in private CLs (66.66% of private CLs operators). However, only 3 operators used TRA regularly (5.66%). One cardiologist operated in a private CL (4.76% of private CLs operators) and 2 operators who performed in public CLs (6.25% of public CLs operators). In 2013, there were 59 operators [35 in public CLs (59.3%)]. Seventeen (25.4%) operators were familiarized with the method and 15 of these operators performed in public CLs (42.85% of public CLs operators). There were 29 regular TRA operators (49.15%). Of these operators, 22 cardiologists operated in private CLs (91.67% of private CLs operators) and 7 operators performed in public CLs (20% of public CL operators) (Figure 3, Table 2).

Table 1 The number of coronary angiographies (CAs), percutaneous coronary interventions (PCIs) and interventions as a whole (both CAs and PCIs) in public catheterization laboratories (CLs), private CLs and both public and private CLs. The use of trans-radial access (TRA) in CAs, PCIs and interventions as a whole in public CLs, private CLs and both public and private CLs was also demonstrated.

	2004	2009	2013
CAs, total	15331	18142	17459
CAs, public CLs	5616	8246	10495
CAs, private CLs	9715	9896	6964
PCIs, total	5028	6848	6539
PCIs, public CLs	1983	3205	4161
PCIs, private CLs	3045	3643	2378
Interventions, total	20359	24990	23998
Interventions, public CLs	7599	11451	14656
Interventions, private CLs	12769	13539	9342
TRA in CAs, overall	66 (0.43%)	2227 (12.28%)	6950 (39.81%)
TRA in CAs, public	10 (0.18%)	69 (0.84%)	1641 (15.64%)
TRA in CAs, private	56 (0.58%)	2158 (21.81%)	5309 (76.23%)
TRA in PCIs, overall	19 (0.38%)	630 (9.20%)	2582 (39.49%)
TRA in PCIs, public	2 (0.10%)	17 (0.53%)	966 (23.22%)
TRA in PCIs, private	17 (0.03%)	613 (16.83%)	1616 (67.96%)
TRA in interventions, total	85 (0.42%)	2857 (11.43%)	9532 (39.72%)
TRA in interventions, public	12 (0.06%)	86 (0.34%)	2607 (10.86%)
TRA in interventions, private	73 (0.36%)	2771 (11.09%)	6925 (28.86%)

4. Discussion

In the beginning, a major reason why TRA appeared to have gain acceptance was because it was associated with a significantly lower rate of entry site complications, although sometimes at the expense of a higher rate of

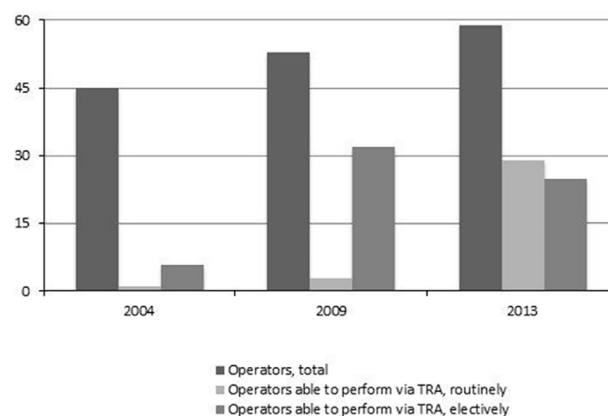


Figure 3 The absolute number of operators in total, as well as those who used trans-radial access (TRA) routinely and electively (familiarized with TRA; however, the trans-femoral approach was the preferred method) in 2004, 2009 and 2013.

Table 2 The number of operators in public catheterization laboratories (CLs), private CLs and in total, as well as the number of operators who either used trans-radial approach (TRA) routinely (preferred method) or electively (familiarized with TRA; however, the trans-femoral access was the preferred method).

	2004	2009	2013
Operators, total	45	53	59
Operators, TRA use routinely, total	1 (2.2%)	3 (5.7%)	29 (49.2%)
Operators, TRA use electively, total	6 (13.3%)	32 (60.4%)	25 (42.4%)
Operators, public CLs	27	32	35
Operators, public CLs, TRA use routinely	0 (0%)	2 (6.3%)	7 (20.0%)
Operators, public CLs, TRA use electively	3 (11.1%)	10 (31.3%)	15 (42.9%)
Operators, private CLs	18	21	24
Operators, private CLs, TRA use routinely	1 (5.6%)	1 (4.8%)	22 (91.7%)
Operators, private CLs, TRA use electively	0 (0%)	14 (66.7%)	2 (8.3%)

procedural failure.⁵ An increasing number of contemporary studies have demonstrated reduced major bleeding and in contrast to findings obtained in initial trials, a downward trend in the primary outcome.¹⁰ Recently, a sub-analysis in the RIVAL trial revealed a decrease in the primary outcome in high-volume radial centers compared with TFA, whereas in low- and intermediate-volume centers, it was not observed.¹¹ Patient comfort in addition to the aforementioned benefits contributed to TRA being the preferred method amongst many countries in Europe and Asia, whilst in America, there was substantial use of TRA only in Canada.¹²

In Greece, there are no official data concerning the use of TRA. The only existing study is the Hellenic Heart Registry on Percutaneous Coronary Interventions in which 18 (36.7%) out of 49 CLs were performed in the Greek territory in 2010, and referred to TRA use in total without any further detail and demonstrated only 3.2% use of TRA.¹³ This is the first study in which a registry of all CLs in central and northern Greece focused on TRA use. Since 2004, there has been an exponential increase in the radial approach in CAs, ranging from 0.43% in 2004 to 12.28% in 2009 and to 39.8% in 2013. With regard to PCIs, these results are similar to CAs since they follow a similarly high pattern: 0.37% in 2004 to 9.20% in 2009 and to 39.4% in 2013. With regard to private CLs, the results are more intriguing such that in 2013, 76.2% of CAs and 68% of PCIs were operated via TRA, while 15.6% and 23.2% were performed in public CLs, respectively. The geometric progression of TRA use is similar to TRA use in PCIs in the United States¹⁴; however, there is 2.5 times more frequent use of TRA in central and northern Greece. TRA has been used by Greek interventional cardiologists for more than a decade, and it has since gained increasing attention. A greater number of interventional cardiologists are trained in this technique and more cardiologists are beginning to use the technique in everyday practice, offering their patients with a lower

complication rate and shorter hospitalization period. The majority of procedures are still performed using TFA; nevertheless, the popularity gained by TRA will soon exceed that of TFA.

With regards to the operators, there is an upward trend in the use of TRA. In 2013, all operators were able to use the method in private CLs; 22 of the operators used the method routinely, while the other 2 operators used TRA electively. In public CLs, there was an exponential increase in operators who were able to use the method (85.71%); 7 of the operators used the method routinely and 23 operators used TRA electively. In private CLs, TRA was more popular, potentially due to patient demand. These patients are also sponsors of the procedure. In contrast, in public CLs, where patients do not contribute to the procedural expenses, the operators predominantly follow their own wishes and less of the patients' desires. However, there is substantial increase in the number of procedures performed on TRA, although the rate is less dramatic compared to that observed in private CLs.

Interestingly, the financial crisis in Greece has had an effect on the way people approach public health services. In 2009, 54.55% of CAs and 53.2% of PCIs were performed in private CLs, whereas in 2013, there were 39.89% of CAs and 36.37% of PCIs performed in private CLs. Thus, there was a 29.63% decrease in CAs and 34.72% decrease in PCIs performed in private CLs, and a 27.27% increase in CAs and 29.83% in PCIs in public CLs. The total loss in turnover for private CLs was 31% (from 13,539 interventions in 2009 to 9,342 in 2013), whilst the total gain in turnover for public CLs was 27.99% (from 11,451 interventions in 2009 to 14,656 in 2013). In addition, in 2009, there was an 18.34% increase in the number of CAs and 36.2% increase in the number of PCIs compared to 2004. However, there was a 3.76% decrease in the total number of CAs and 4.51% decrease in the total number of PCIs in 2013 compared to 2009. These statistics indicate a restriction in coronary interventions in total, potentially due to the stricter obedience to formal indications and consequently from the shortage in necessary materials. In addition, it also suggests the citizens' preference for public services, as they do not impose an extra financial burden.

5. Study Limitations

The results were based on a questionnaire provided by Greek interventional cardiologists. Although the investigators took particular care to explain the purpose of the study to obtain meaningful responses, the actual clinical practices may differ from those previously reported.

6. Conclusions

This is the first study to reveal the volumes and trends in interventions performed on TRA across central and northern Greece. The current study demonstrates that TRA has gained a reputation among operators in both public and private CLs, but is more popular in private CLs. Interestingly, as a result of the financial crisis, the number of catheterizations in Greece had diminished, whereas private CLs lost a great amount of their turnover.

Conflicts of Interest

None.

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