

# Appropriateness of referrals for single-photon emission computed tomography myocardial perfusion imaging (SPECT-MPI) in Iran

Ali Gholamrezanezhad<sup>1,2</sup>, Ahmadali Shirafkan<sup>2,3</sup>, Sahar Mirpour<sup>1</sup>

<sup>1</sup>Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Tehran, Iran.

<sup>2</sup>Golestan Cardiovascular Research Center, <sup>3</sup>Department of Cardiology, 5<sup>th</sup> Azar Hospital, Golestan University of Medical Sciences, Gorgan, Iran.

(Received 25 October 2011, Revised 6 December 2011, Accepted 14 December 2011)

**Iran J Nucl Med 2011;19(1):1-5**

**Corresponding author:** Dr Ali Gholamrezanezhad, Research Institute for Nuclear Medicine, Tehran University of Medical Sciences, Shariati Hospital, North Kargar Ave. 1411713135, Tehran, Iran.  
E-mail: gholamrezanezhad@razi.tums.ac.ir

**Keywords:** Appropriateness criteria, Guidelines, Myocardial perfusion imaging.

## EDITORIAL

Documented evidences available from both developed and developing countries reveal that the number of clinical imaging procedures and instruments have continued to increase over the past decades, confirming the increasing demand for these clinical imaging modalities (1-5). Accordingly, concerns about over-utilization and inappropriate use in imaging have been raised, and consequently medical authorities and clinicians who were slow to respond to spiraling costs of cardiac imaging years ago, now recognize the need to promote appropriate and cost-conscious use of

imaging, mainly through the development of appropriateness criteria and guidelines, which are focused on eliminating unnecessary testing to decrease health care costs (6, 7).

As an important section of clinical imaging, nuclear medicine imagings have grown tremendously over the past 50 years and they now play an important role in all medical disciplines (2). Single-photon Emission Computed Tomography Myocardial Perfusion Imaging (SPECT-MPI) is one of the most widely used procedures of nuclear medicine that is usually applied to detect perfusion abnormalities and foster improved

detection of patients at-risk (8). As similar to other advanced clinical imaging modalities, the number of myocardial perfusion scans performed annually in developed countries has increased (5, 8). For example, the number in Ontario (Canada) has increased by 101% between 1996/1997 and 2005/2006 (3) and also in Germany the number of myocardial perfusion scintigraphies actually increased between 2005 and 2006, despite the emergence of competing methods (9). The same figure is available from both the United States and other European countries: since 1998, the rates for SPECT-MPIs have increased from 10% to 30% per year (5, 6). Regarding these features, countries like United States, Canada, most western European countries, Australia, and Japan have been reported to have high or moderate-high nuclear cardiology utilization (8).

However, dramatic growth in the physicians' request of imaging modalities –such as SPECT-MPI- and their dependence to clinical imaging for diagnosis of the diseases (10, 11) has led authorities to question the appropriateness of the referrals and consider strategies to constrain further diagnostic test growth. In this regard, special attention has been paid to cardiovascular diagnostic procedures due to their clinical importance and high costs: numerous studies are available to evaluate the contributing factors in physicians' decision to refer a patient for cardiac catheterization (12-15) or cardiac computed tomography (16).

Although emphases have been made by authorities in the American College of Cardiology Foundation (ACCF) and the American Society of Nuclear Cardiology (ASNC) (17, 18), appropriateness of MPI referrals in developing countries has not been previously studied extensively and also just few studies have been reported from the developed nations (19-21).

Particularly in developing nations, this is mainly because governmental endeavors to

establish a health technology assessment unit are still in the early stages (1, 22).

### Appropriateness of referrals in IRAN

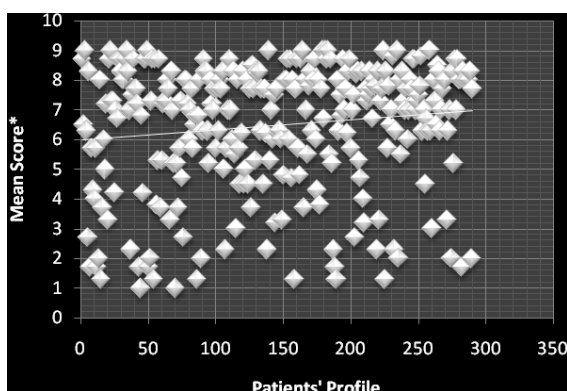
Recently we conducted a study (23) to describe the ordering practices of physicians and appropriateness of MPI referrals in multiple clinical sites of Iran (as a developing country), by use of ACCF/ASNC Guidelines for the Clinical Use of Cardiac Radionuclide Imaging as the major background reference (24, 25).

For the study purpose, we convened a panel, consisted of two cardiologists, one internist, and one nuclear medicine physician. The moderator of the session presented each case in the face-to-face meeting. Then the panelists were invited to judge appropriateness of SPECT-MPI for each patient on a 9-point scale, on which scores of 1 to 3 denoted inappropriate referral (no benefit of SPECT-MPI), 4 to 6 denoted uncertainty about use (when harms and benefits were judged as approximately equal, or when the best available evidence did not support a judgment either way), and 7 to 9 denoted appropriate use (benefits were judged to outweigh harms) (26). Calculating the mean of scores from four panelists, the mean of 7-9 was considered appropriate (A), 3.1-6.9 uncertain (U), and 1-3 inappropriate (I).

At the next step, panelists were asked to independently assign a specific indication (scenario), whenever possible in accordance with ACCF/ASNC appropriateness scenarios for each case. In this line, SPECT-MPI studies were then classified into appropriate, inappropriate, uncertain, or unclassified (when the consensus of the panelists was that the case did not matched to any of the presented scenarios of ACCF/ASNC Guidelines) (26).

Two hundred and ninety one patients (167 female, 124 male, mean age of  $55.3 \pm 10.3$  years) entered the study. The level of appropriateness of referrals for SPECT-MPI

was judged appropriate for 56.0%, uncertain for 33.3% and inappropriate for 10.7% patients (Fig. 1). Based on the ACCF/ASNC appropriateness criteria, SPECT-MPI testing were judged appropriate for 72.5%, uncertain for 12.4% and inappropriate for 11.0% of referrals (26). Panelists had consensus that in 4.1% referrals, the case do not matched to any of the 52 presented scenarios of 2005 ACCF/ASNC Guidelines (unclassified).



**Fig. 1.** The distribution of referrals based on the nine-point scale rating of the panel.

(\* For each referral, a mean score of 1 to 3 was defined as “inappropriate”, 3.1 to 6.9 as “uncertain”, and 7 to 9 as “appropriate”. The agreement among the observers was good; ICC: 0.68;  $P < 0.001$ ).

Regarding the level of appropriateness of referrals, there was no significant difference between hospital-based governmental and private free-standing nuclear medicine centers. SPECT-MPIs were interpreted as normal in 69.8% and abnormal in 30.2% patients. A higher percentage of referrals with inappropriate indications were normal as compared to the appropriate referrals (26).

#### Good news for Iranian medical community

Driven by the monetary interest of free-market financing structure of health care providers, developing countries have been experiencing a rapid expansion and fast

growth in conventional nuclear medicine technology (2). The number of conventional nuclear medicine facilities in some of these countries has risen by more than 2.2 fold in less than a decade, and nuclear cardiology applications remain one of the most prevalent requested procedures of this technology (10). These statistics have caused a remarkable apprehension and debate on the ordering habits of cardiologists, whether this explosion of nuclear cardiology technology to developing countries is justified, logical and clinically needed.

According to our study findings, a high percentage of SPECT-MPI procedures in Iran are being done with appropriate indications, comparable with that found in developed (18, 19, 27) and other developing nations (23), where 64-87% of studies were deemed appropriate. This is good news for developing countries, since many health authorities as concerned that a remarkable portion of the current referrals are not “efficient”. Fragile structure of insurance companies aggravates these concerns (2), which seems to be supported by no documented evidence.

Although up to a quarter of referrals are ordered with uncertain or inappropriate indications, our study provides an evidence for the fact that SPECT-MPI ordering practices in our developing community largely parallel the ACCF/ASNC recommendations (26).

#### Strengths and weaknesses of appropriateness criteria

Similar to previous reports (18, 19, 27), our study support the assumption that coming into clinical practice, the appropriateness criteria encounter some limitations: The supporting evidences originate from registry data and expert opinion. Although these evidences are applicable to a wide variety of (but not all) the clinical situations, occasionally deal with cut-and-dried situations cannot cover all the real-life

clinical scenarios meet by cardiologists, which are usually complex (28). These recommendations must continue to be updated and refined to ensure their coverage on all possible clinical scenarios encountered in daily practice of referring physicians. However, ACCF/ASNC criteria are strong enough to be considered as the basis for reimbursement for SPECT-MPI referrals.

### REFERENCES

1. Palesh M, Fredrikson S, Jamshidi H, Jonsson PM, Tomson G. Diffusion of magnetic resonance imaging in Iran. *Int J Technol Assess Health Care*. 2007 Spring;23(2):278-85.
2. Gholamrezanezhad A, Mirpour S, Behbahani AA. Nuclear medicine in developing countries: perspective from Iran. *J Nucl Med*. 2010 May;51(5):14N-19N, 22N.
3. You JJ, Alter DA, Iron K, Slaughter PM, Kopp A, Przbysz R et al. Diagnostic services in Ontario: Descriptive analysis and jurisdictional review. ICES Investigative Report. Toronto, Canada: Institute for Clinical Evaluative Sciences; 2007.
4. Canadian Institute for Health Information, Medical Imaging in Canada, 2007. Ottawa, Ont.: CIHI, 2008.
5. Kamínek M, Mysliveček M, Lang O, Fikrle A. Increase in utilization of myocardial perfusion imaging in the Czech Republic: activity and practice of nuclear cardiology, 2003. *Nucl Med Rev Cent East Eur*. 2005;8(1):11-4.
6. Des Prez RD, Shaw LJ, Gillespie RL, Jaber WA, Noble GL, Soman P et al. Cost-effectiveness of myocardial perfusion imaging: a summary of the currently available literature. *J Nucl Cardiol*. 2005 Nov-Dec;12(6):750-9.
7. Hendel RC. Utilization management of cardiovascular imaging pre-certification and appropriateness. *JACC Cardiovasc Imaging*. 2008 Mar;1(2):241-8.
8. Vitola JV, Shaw LJ, Allam AH, Orellana P, Peix A, Ellmann A et al. Assessing the need for nuclear cardiology and other advanced cardiac imaging modalities in the developing world. *J Nucl Cardiol*. 2009 Nov-Dec;16(6):956-61.
9. Lindner O, Burchert W, Bengel FM, Zimmermann R, Vom Dahl J, Schäfer W et al. Arbeitsgemeinschaft kardiovaskuläre nuklearmedizin der deutschen gesellschaft für nuklearmedizin; arbeitsgruppe nuklearkardiologische diagnostik der deutschen gesellschaft für kardiologie, herz und kreislaufforschung. Myocardial perfusion scintigraphy 2006 in Germany. Results of the query and current status. *Nuklearmedizin*. 2008;47(4):139-45.
10. Zakavi SR. Nuclear cardiology in Iran in 2002. *Iran J Nucl Med*. 2004;12(21):73-78.
11. Kelion AD, Anagnostopoulos C, Harbinson M, Underwood SR, Metcalfe M, British Nucl Cardiology Society. Myocardial perfusion scintigraphy in the UK: insights from the British Nuclear Cardiology Society Survey 2000. *Heart*. 2005 September; 91(Suppl 4): iv2-iv5.
12. Bernstein SJ, Brorsson B, Aberg T, Emanuelsson H, Brook RH, Werkö L. Appropriateness of referral of coronary angiography patients in Sweden. SECOR/SBU Project Group. *Heart*. 1999 May;81(5):470-7.
13. Anderson GM, Pinfold SP, Hux JE, Naylor CD. Case selection and appropriateness of coronary angiography and coronary artery bypass graft surgery in British Columbia and Ontario. *Can J Cardiol*. 1997 Mar;13(3):246-52.
14. Henderson RA, Raskino CL, Hampton JR. Variations in the use of coronary arteriography in the UK: the RITA trial coronary arteriogram register. *QJM*. 1995 Mar;88(3):167-73.
15. Barnhart J, Bernstein SJ. Is coronary angiography underused in an inner-city population? *Ethn Dis*. 2006 Summer;16(3):659-65.
16. Ayyad AE, Cole J, Syed A, Desai MY, Halliburton S, Schoenhagen P et al. Temporal trends in utilization of cardiac computed tomography. *J Cardiovasc Comput Tomogr*. 2009 Jan-Feb;3(1):16-21.
17. Ward RP, Al-Mallah MH, Grossman GB, Hansen CL, Hendel RC, Kerwin TC et al. American Society of Nuclear Cardiology review of the ACCF/ASNC appropriateness criteria for single-photon emission computed tomography myocardial perfusion imaging (SPECT MPI). *J Nucl Cardiol*. 2007 Nov-Dec;14(6):e26-38.

18. Klocke FJ, Baird MG, Lorell BH, Bateman TM, Messer JV, Berman DS et al. ACC/AHA/ASNC guidelines for the clinical use of cardiac radionuclide imaging--executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASNC Committee to Revise the 1995 Guidelines for the Clinical Use of Cardiac Radionuclide Imaging). *J Am Coll Cardiol.* 2003 Oct 1;42(7):1318-33.
19. Gibbons RJ, Miller TD, Hodge D, Urban L, Araoz PA, Pellikka P et al. Application of appropriateness criteria to stress single-photon emission computed tomography sestamibi studies and stress echocardiograms in an academic medical center. *J Am Coll Cardiol.* 2008 Apr;51(13):1283-9.
20. Hendel RC, Cerqueira M, Douglas PS, Caruth KC, Allen JM, Jensen NC et al. A multicenter assessment of the use of single-photon emission computed tomography myocardial perfusion imaging with appropriateness criteria. *J Am Coll Cardiol.* 2010 Jan;55(2):156-62.
21. McCully RB, Pellikka PA, Hodge DO, Araoz PA, Miller TD, Gibbons RJ. Applicability of appropriateness criteria for stress imaging: similarities and differences between stress echocardiography and single-photon emission computed tomography myocardial perfusion imaging criteria. *Circ Cardiovasc Imaging.* 2009 May;2(3):213-8.
22. World Health Organization. Health system profile - Islamic Republic of Iran. Regional Office for the Eastern Mediterranean (WHO/EMRO); 2004.
23. Gholamrezanezhad A, Shirafkan A, Mirpour S, Rayatnavaz M, Alborzi A, Mogharrabi M et al. Appropriateness of referrals for single-photon emission computed tomography myocardial perfusion imaging (SPECT-MPI) in a developing community: A comparison between 2005 and 2009 versions of ACCF/ASNC appropriateness criteria. *J Nucl Cardiol.* 2011 Dec;18(6):1044-52.
24. Brindis RG, Douglas PS, Hendel RC, Peterson ED, Wolk MJ, Allen JM et al. ACCF/ASNC appropriateness criteria for single-photon emission computed tomography myocardial perfusion imaging (SPECT MPI): a report of the American College of Cardiology Foundation Quality Strategic Directions Committee Appropriateness Criteria Working Group and the American Society of Nuclear Cardiology endorsed by the American Heart Association. *J Am Coll Cardiol.* 2005 Oct;46(8):1587-605.
25. Hendel RC, Berman DS, Di Carli MF, Heidenreich PA, Henkin RE, Pellikka PA et al. ACCF/ASNC/ACR/AHA/ASE/SCCT/SCMR/SNM 2009 Appropriate Use Criteria for Cardiac Radionuclide Imaging: A Report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, the American Society of Nuclear Cardiology, the American College of Radiology, the American Heart Association, the American Society of Echocardiography, the Society of Cardiovascular Computed Tomography, the Society for Cardiovascular Magnetic Resonance, and the Society of Nuclear Medicine. *J Am Coll Cardiol.* 2009 Jun;53(23):2201-29.
26. Hemingway H, Chen R, Junghans C, Timmis A, Eldridge S, Black N et al. Appropriateness criteria for coronary angiography in angina: reliability and validity. *Ann Intern Med.* 2008 Aug;149(4):221-31.
27. Mehta R, Ward RP, Chandra S, Agarwal R, Williams KA; American College of Cardiology Foundation; American Society of Nuclear Cardiology. Evaluation of the American College of Cardiology Foundation/American Society of Nuclear Cardiology appropriateness criteria for SPECT myocardial perfusion imaging. *J Nucl Cardiol.* 2008 May-Jun;15(3):337-44.
28. Faxon DP. Assessing appropriateness of coronary angiography: another step in improving quality. *Ann Intern Med.* 2008 Aug 19;149(4):276-8.