

## **Myocardial perfusion imaging agent with pharmacological stress**



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### **INTRODUCTION:**

Physiological stress is rated best for stressing myocardium for performing myocardial perfusion imaging. Rheumatoid arthritis, joint problems, amputation of leg and poor compliance of exercises are certain conditions when pharmacological stressing with dobutamine or adenosine has to be undertaken. Pharmacological stress though more costly it is actually more powerful as a stressor of the coronary perfusion system, this is well tolerated by patients and rapid to perform(1) . In considering how the different available radiopharmaceuticals may interact with pharmacological agents there by over estimating the flow in regions of low perfusion as well as over estimation of viability (3). Low counts within myocardium leads to low target to non-target ratio and under estimation of flow and low estimation of defects. This study is an analysis of data of patients where pharmacological stress has been given and three available radiopharmaceutical agents have been compared for clinical efficacy and detection of coronary artery disease.

### **MATERIAL & METHODS**

In this retrospective study dobutamine IV infusion has been used as stressing agent. Ten patients each with Thallium - 201, Technetium Sestamibi and Technetium tetrofosmin has been analyzed for the quality of images compared with coronary angiography findings in each groups. These findings are also compared with results of patients who have undergone physiological exercise on treadmill according to bruce protocol, for TI-201 (111 Mbq, 3mCi) IV injection was used during stress with redistribution at rest and reinjection where indicated) For Tc-99m tracer it was a one day stress/ rest protocol using 250 MBq (7mCi) followed by 750 MBq (20mCi) stress rest imaging same day protocol with 180 degree SPECT acquisition on a single head gamma camera. In all patients myocardial images were analyzed both visually and quantitatively.

## RESULTS

Radiopharmaceutical stress using dobutamine could achieve the targeted stress in all patients without any major complications except noticeable palpitation in 60% of patients.

A total of 30 Patients were studied. These patients were divided in to three groups and analyzed.

(I) Age and sex analysis is shown in following table, it shows age and ex matching in three groups

	TI-201	Tc-99m MIBI	Tc-99m tetrofosmin
Age Range in years	44-74	42-46	40-72
Male Female Ratio	5:1	5:1	5:1

(II) Visual analysis of TI-201 images showed slightly low resolution images compared to Tc-99m tracers.

(III) There was no difference between two Tc-99m tracers however easy preparation of tetrofosmin and 20 minutes boiling of Sestamibi has some limitation as there is loss of radioactivity for 20 minutes in a short liver isotopes having six hours halflife .

(IV) Comparison with angiography findings in three groups shows minimal variation which has no statistical significance. Details are shown in following table

	TI-201		Tc-99m MIBI		Tc-99m tetrofosmin	
	Sensitivity	Specificity	Sensitivity	Specificity	Sensitivity	Specificity
Correlation Angiography	78%	65.4%	79%	66%	79%	68%

(V) There is no difference between the clinical efficacy of the three agents of demonstration of defect extent and severity in stress and rest images.

(VI) The quality of scans studied with Thallium -201 were compared with Technetium – 99m agents final results do not show a significant difference.

(VII) On quantitative analysis of the images with Bull's eye analysis (CTQ analysis ) for percentage of defect mapping there was no significant difference in total percentage of defect shown in three groups.

(VIII) Attenuation artifacts were noted in females when Tl-201 tracer was used. When both the Tc-99m tracer was compared there is no significant difference noted. An effect of breast attenuation is seen with Tl-201 compared to Tc-99m .

### **DISCUSSION:**

The study compares the available myocardial perfusion agents with pharmacological stress using dobutamine infusion, age and sex matched three groups are studied. The study shows a male preponderance since defence forces are male dominant society. Tamaki et al 1994(1) have shown 75% sensitivity to detect coronary artery disease lesions with pharmacological stress. This study has shown 78% to 79% sensitivity.

Thallium 201 images have shown slightly low resolution of images due to lesser dose administration and tracer kinetics. Dose injected for thallium is limited to 3mCi where as technetium agents can be injected up to 25mCi doses giving better image quality. Gomez et al 1995 (4) and Patric Flaman et al 1995 (2) have supported these findings. Thallium - 201 has half life of 72 hrs there by limiting the dose to 111M bq is essentially contributing for breast attenuation artifacts in anterior projections in female patients. Where as higher dose administration of Tc-99m tracers without higher radiation doses to patients over comes this technical difficulty.

Sestamibi kits require boiling for 20 minutes for proper tagging there by decay of Technetium for 20 minutes compared to tetrofosmin which is a mix and use kit making it more user friendly (Product information with Sestamibi kits and tetrofosmin kits)

### **SUMMARY**

Angiography comparison in all the three groups is similar without any significant difference therefore all the three tracers have equal detection of coronary artery disease.

Quantitative analysis on CTQ has also not shown any significant difference in three groups when compared attenuation artifacts in females in anterior wall of myocardial segment are seen due to breast

attenuation. This problem is overcome by strapping the breast out of myocardial field.

Comparison of the quantitative analysis in different groups has limitations in that the same patient should have been studied with all the three isotopes to be compared.

### **CONCLUSION:**

In conclusion

- All tracers perform well pharmacological stress using dobutamine for the detection of coronary artery disease .
- Image quality is superior with Technetium 99m agents.
- Comparison between two Tc-99m tracers with Tl-201 difference are clinically not significant
- Tetrofosmin is simple to prepare compared to Sestamibi

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