SUDAN HEART JOURNAL | Official Journal of the Sudan Heart Society | ISSN 1858-6783 (Print) / 1858-6791 (Online)
Vol. 9, No. 1 (Spring 2021) • Manuscript: SHJ-2021-V9N1-01 • DOI: 10.25239/SHJ/Vol9/No1/Original1

Original Article

Survey of Radiation Protection Measurements in Cardiac Catheterization Laboratories in Sudan

Anas Babiker[1], **Ahmed Ali Ahmed Suliman**[2], **Mohamed Elhassan**[3], **Usama Salih**[3], **Mahir Nuri**[3], **Samoal Dafalla**[3], **Awad Mohamed**[4], **Eltayib M. Ahmed**[3], **Mohmed Badri**[3], **Mustafa Ibrahim**[3], **Yasseen Abdelhai**[5]

[1] Ahmed Gasim Teaching Hospital & Alzaytouna Specialist Hospital, Khartoum, Sudan
[2] Department of Cardiology, Shaab Teaching Hospital & Faculty of Medicine, University of Khartoum, Sudan
[3] Cardiac Catheterization Group, Sudan Heart Society
[4] Shab Teaching Hospital, Khartoum, Sudan
[5] Sudan Heart Society & Cardiac Catheterization Group, Khartoum, Sudan

Correspondence: Anas Babiker (abumalik12@hotmail.com)

Abstract

National cross-sectional survey across 12 cardiac catheterization laboratories (10 in Khartoum, 2 regional) and 81 cath-lab personnel in Sudan assessing radiation protection hardware, routine dosimetry, and ALARA adherence. While 100% of centers had thyroid collars, none performed regular apron or dosimeter checks, and only 12% of staff always wore lead glasses and 1% consistently wore dosimeters.

Introduction

Cardiac catherization laboratory (cath lab) services in Sudan are quite established and has seen a remarkable increase in volume and centers since the turn of the century. (1)

With increase in the number volumes, the issue of radiation protections for both patients and cath lab staff becomes more urgent and more important. Radiation has no minimum safety threshold and its adverse effects occur in a linear, dose-dependent risk. (2) In this article we aim to study the different protection measurements implemented in cath labs in Sudan.

Methods

This was a hospital based online survey conducted in December 2019. The survey is of two parts. The first part was answered by the cath lab director or head of department and collected data on availability of radiation protection tools (namely over-table lead shield, under-table lead shield, lead caps, lead glasses), routine check-up of lead aprons, presence of radiation officer in the hospital, presence of radiation dosimeters and radiation protection courses and certification.

The second part was answered by cath lab staff and collected data on age, gender, use of radiation protection tools, radiation protection courses and routine health checks.

Twelve cath labs have participated from all over Sudan. These are Shab Teaching Hospital, Ahmed Gasim Hospital, Sudan Heart Center, Omdurman Hospital, Almawada Hospital, Fedail Hospital, Al Zaitona Hospital, Al Molem Hospital, Merowe Hospital, Wad Madani Cardiac center, Police Hospital, and Doctor's Clinic.

Data was analyzed using simple descriptive analysis .

Results

Twelve cath labs were surveyed; ten in the capital and 2 outside the capital in Merowe and Wad Madani. From cath lab directors response, 42% had above-table shield, 25% had below-table shield, none had regular apron check,

100% had lead collars, 11% had lead caps, 44% had lead glasses, none had regular dosimeter checks, 11% had in house radiation officer, 44% had regular cath lab machine maintenance, none required radiation protection certification for the staff, a no cath lab director is aware of staff leaving because of radiation concerns.

Figure (1), shows the details of the responses from cath lab directors.

Eighty one cath lab staff responded to the survey, with 30% female and 70% male. Age distribution of cath lab staff is shown in figure 2.

Of all the responders, 47% were cardiologists, 27% were cardiology fellows, 20% were cath lab technicians and scrub nurses and 6% were radiographers.

Regarding use of radiation protection measures, only 4% used protective caps always, 12% always lead glasses, and only 1% always wears a dosimeter.

Figure (3) shows the details of cath lab staff response to use of radiation protection measures.

Only 20% of the responders have attended a radiation protection course. Only 7% have routine blood checks .

Discussion

Our study shows poor adherence to best practices for radiation protection to cath lab staff and patients. Lack of regular maintenance and radiation officers is seen in almost all surveyed labs. Maintaining a radioprotective shield between the operator and radiation source, proper lead apron use, thyroid collar and radioprotective glasses are essential elements of radiation protection. Lead or lead-equivalent hats may reduce cranial dose, but potential benefits are, to date, theoretical, based upon anecdotal reports of increased left-sided brain tumors in interventional cardiologists. (3)(4)

The ALARA (as low as reasonably achievable) principle has long been the guiding principle governing medical radiation exposure. It is based on the linear-no threshold model of radiation cancer risk and states that medical radiation exposure should be employed judiciously and that healthcare professionals are responsible to minimize radiation exposure both to patients and to healthcare personnel.(5)

The free program for cardiac catherization in Sudan provides supplies for public hospitals that in turn provide free services to patients.(6)Part of the budget should allotted to improving the cath lab environment including radiation protection measures.

References

1- Suliman AAA. Development and current status of Interventional cardiology in Sudan. Eur Heart J. 2021 Mar 31;42(13):1190-1191. doi: 10.1093/eurheartj/ehaa1056. PMID: 33378416.

2- Valentin J. The 2007 recommendations of the international commission on radiological protection. ICRP publication 103. Ann iCRP 2007;37:1-332.

3- Hirshfeld JW Jr, Ferrari VA, Bengel FM, Bergersen L, Chambers CE, Einstein AJ, Eisenberg MJ, Fogel MA, Gerber TC, Haines DE, Laskey WK, Limacher MC, Nichols KJ, Pryma DA, Raff GL, Rubin GD, Smith D, Stillman AE, Thomas SA, Tsai TT, Wagner LK, Wann LS. 2018 ACC/HRS/NASCI/SCAI/SCCT Expert Consensus Document on Optimal Use of Ionizing Radiation in Cardiovascular Imaging-Best Practices for Safety and Effectiveness, Part 2: Radiological Equipment Operation, Dose-Sparing Methodologies, Patient and Medical Personnel Protection: A Report of the American College of Cardiology Task Force on Expert Consensus Decision Pathways. J Am Coll Cardiol. 2018 Jun 19;71(24):2829-2855. doi: 10.1016/j.jacc.2018.02.018. Epub 2018 May 2. PMID: 29729878.

4-R.R. Reeves, L. Ang, J. Bahadorani, et al.Invasive cardiologists are exposed to greater left sided cranial radiation: the BRAIN study (Brain Radiation Exposure And Attenuation During Invasive Cardiology Procedures). J Am Coll Cardiol Intv, 8 (2015), pp. 1197-1206

5- Miller, Donald & Schauer, David. (2015). The ALARA principle in medical imaging.. AAPM Newsletter. 40. 38-40.

Available online @https://www.researchgate.net/publication/272504868_The_ALARA_principle_in_medical_imaging/citation/download. Last accessed 26/10/2021.

6- Khalil S. Impact of the National Program for Free Treatment on the

burden of Heart Disease. Sudan Heart Journal. 2019:6;2 (1-4). DOI: http://dx.doi.org/10.25239/SHJ/Vol6/No2/Editorial

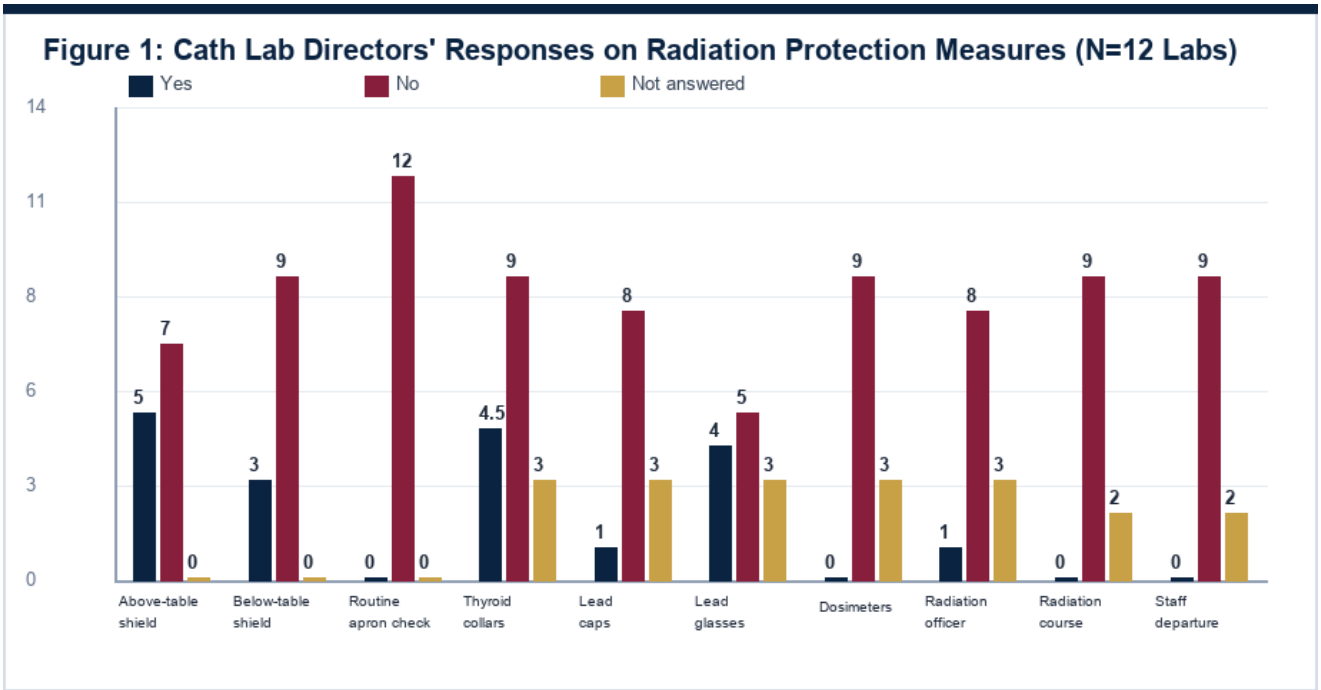

Figure 1: Cath Lab Directors' Responses on Radiation Protection Measures (N=12 Labs)

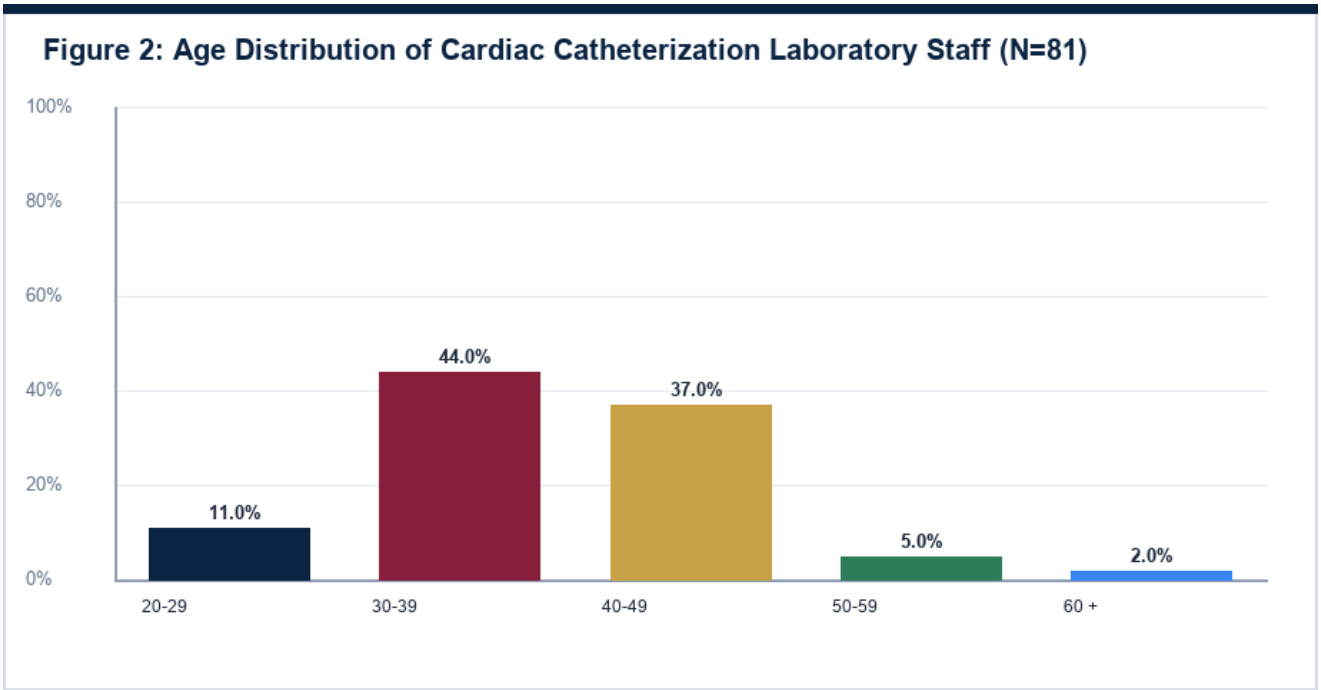

Figure 2: Age Distribution of Cardiac Catheterization Laboratory Staff (N=81)

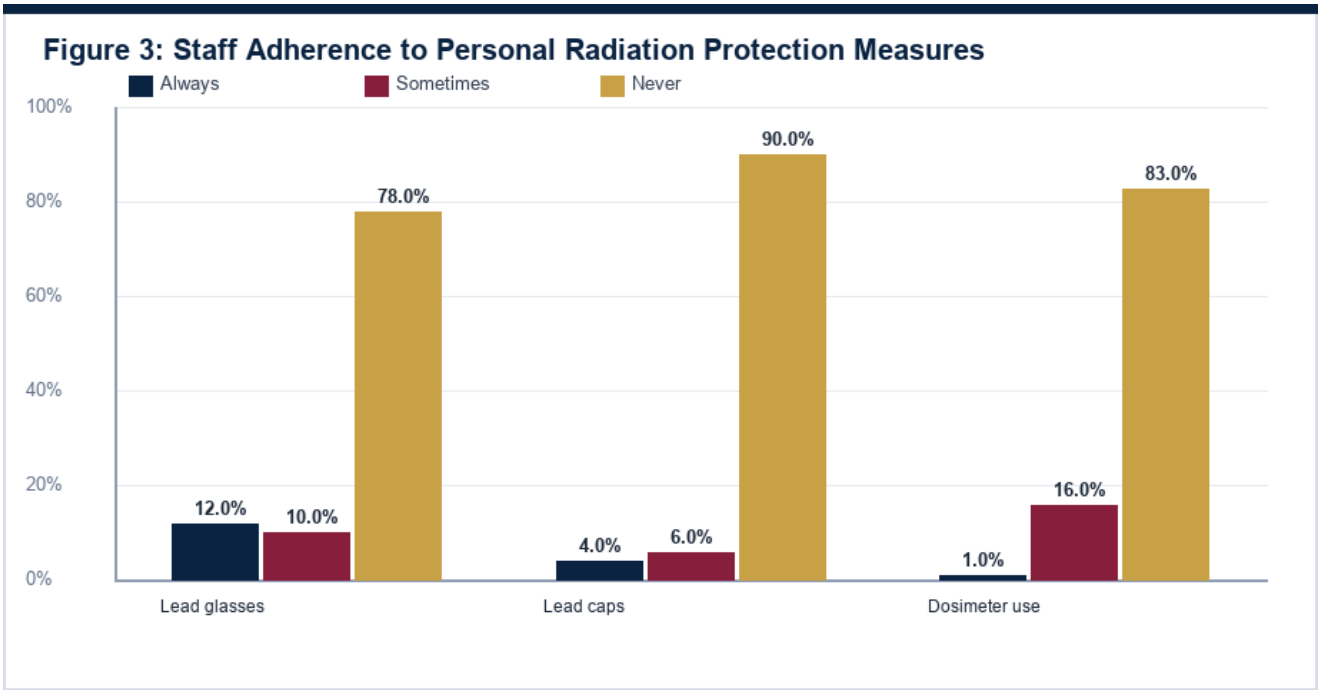

Figure 3: Staff Adherence to Personal Radiation Protection Measures