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Prevalence of Brain and Neck Neoplasms among Interventional Cardiologists; A Multicenter Study

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ABSTRACT

Objective: To determine the prevalence of brain and neck neoplasms among Interventional Cardiologists.

Study Design: Analytical cross-sectional study.

Place and Duration of Study: Department of Cardiology/Interventional Cardiology of two Tertiary Cardiac Care Centers of Rawalpindi and Lahore Pakistan from Mar 2021 to Apr 2022.

Methodology: By using the non-probability, consecutive sampling technique, fifty Interventional Cardiologists' (n=50) of both genders between 35-75 years of age, working in the cardiac catheterization labs for more than 10-years are enrolled after their informed consents. The data was collected from the interviews of Interventional cardiologists, from the shared medical records and also from the family members and colleagues. The Interventional cardiologists were enquired about any neurological signs and symptoms particularly in relation to the head and neck malignancy and also asked about undergoing any CT/MRI or PET scan of head and neck region in the past or recent time. Descriptive statistics for data was computed by using the SPSS version 25.

Results: The mean age of the Interventional Cardiologists of tertiary cardiac care center of Rawalpindi was 50.40±7.77years while of Lahore was 49.16±8.89 years. There were 47(94.0%) males and 3 (6.0%) females, from both the Institutes. The mean duration of working in cardiac catheterization labs was 17.92±4.57 years. The head and neck neoplasm's among Interventional Cardiologists was observed in 01(2%) case.

Conclusion: The research study concluded that the prevalence of head and neck neoplasms among Interventional Cardiologists is very low (2%). But still it is the need of hour to be more careful about radiation exposure among the Interventional Cardiologists working for long hours in the cardiac catheterization labs, to lessen down the chances of head and neck malignancy.

Keywords: Cardiac catheterization, Head & neck malignancy, Interventional cardiologists, Ionizing radiation, Percutaneous coronary intervention.

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INTRODUCTION

The most common cardiac invasive procedure for treating patients with coronary artery disease is Percutaneous Coronary Intervention (PCI).[1] With the Introduction of coronary artery stents (DES/BMS/ Covered Stents) and the optimal use of anti-platelet and anti-thrombotic medications, dreadful complications such as coronary artery dissection or coronary artery perforation in the previous balloon angioplasty era have been significantly reduced.[2,3] Interventional cardiologists who work in cardiac catheterization labs for long hours are exposed to continuous low levels of ionizing radiation, which can be harmful to their health.[4]

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The damage to the DNA of cells by ionizing radiation is thought to be the key mechanism that leads to the development of uncontrolled cellular growth.[5,6] The most common primary malignant brain tumour in adults is glioma, which has a poor prognosis. In the Industrialized world, the age-specific incidence of this tumour is very high, and this appears to be partly explained by the advanced diagnostic techniques.[6] Despite the fact that many epidemiological studies have looked at the role of potential risk factors for causing glioma, its etiology is unknown, and there appears to be no link between glioma and the various dietary and lifestyle factors which are linked to the cancer of other body organs.[7]

Brain tumor results from an uncontrolled proliferation of cells derived from neural tissue or structural, supportive (glial) tissue within the brain. Brain

tumors can be benign or malignant. Most are localized growths, but some disseminate throughout the central nervous system (CNS), and in rare instances spread outside the CNS. Ionizing radiation is a type of high-energy radiation, which has enough energy to remove an electron (negative particle) from an atom or molecule, causing it to become ionized. Ionizing radiation can cause chemical changes in cells of brain and damage DNA. Males have a higher incidence of developing glioma than females, and ionizing as well as non-ionizing radiation, has been postulated as a probable risk factor for causing glioma.[8,9] Many prior researches have looked into whether occupational exposure to radiation increases the risk of developing a brain tumour, but their results have been insignificant. The predictive risk factors for developing brain and neck neoplasms among Interventional cardiologists have been extensively studied and documented in the literature.[10] However little data is present for tertiary care hospitals and National Post graduate Institutes in Pakistan. The purpose of this study is to determine the prevalence and the potential risk factors for developing brain and neck neoplasms among Interventional cardiologists.

The study was aimed to determine the prevalence of brain and neck neoplasms among Interventional Cardiologists working in the cardiac catheterization labs, due to long duration of exposure to low doses of ionizing radiation.

METHODOLOGY

This descriptive cross-sectional, multi-centric study was conducted at Department of Cardiology / Interventional Cardiology of two Tertiary Cardiac Care Centers of Rawalpindi Pakistan and Lahore from March 2021 to April 2022.

Sample Size: By using the Non probability, consecutive sampling technique at 95% confidence level, 5% margin of error and 02–05% frequency of brain and neck neoplasms; the sample size was estimated to be n=50 cases.

Inclusion Criteria: Fifty Interventional Cardiologists' of both genders between 35 -75 years of age, working in the cardiac catheterization labs for more than 10 years are enrolled after their informed consents.

Exclusion Criteria: Interventional Cardiologists' with past history of head and neck tumors or undergoing head and neck surgery before started working in cardiac catheterization labs are excluded. Moreover, the Interventional Cardiologists' with past or recent history, under treatment or being treated for other body organ malignancy are also excluded from the study.

After approval from the Institute ethical board review committee (IERB letter #22/2/R&D/2022/165), Fifty Interventional cardiologists working in the department of Interventional Cardiology fulfilling the inclusion criteria were included in the study after explaining and fully informed written consents. The data was reviewed and collected by the interviews of Interventional cardiologists, from the shared medical records and other documents and also from the family members and colleagues. The data was kept confidential. The Interventional cardiologists were enquired about any neurological signs and symptoms particularly in relation to the head and neck malignancy and also asked about undergoing any CT /MRI or PET scan of head and neck region in the past or recent time. All the information gathered from Interventional cardiologists was noted proforma. Descriptive statistics for data was computed by using the Statistical Package for Social Sciences (SPSS) version 25. Frequency and percentages were calculated for categorical variables like gender, diabetes, hypertension and head & neck malignancy. Mean along with standard deviation was calculated for continuous variables like age and BMI (Body Mass Index).

RESULTS

The mean age of all Interventional Cardiologists was 49.78±8.28 years. The mean age of Interventional Cardiologists of Cardiac Center of Rawalpindi was 50.40±7.77 years while of Lahore was 49.16±8.89 years. There were 47(94.0%) males, out of them 25(100%) were from cardiac center of Rawalpindi while 22(88%) were from cardiac center, Lahore. There were total 3 (6.0%) females, and all were practicing in cardiac center of Lahore. The mean BMI of Interventional Cardiologists was 24.70±2.88 kg/m^2. The mean BMI in cardiac center, Rawalpindi was 24.56±2.79 kg/m^2 while in cardiac center, Lahore was 24.83±3.03 kg/m^2. Out of 50 Interventional Cardiologists 3(6.0%) were diabetic and all were from cardiac center of Lahore, 7(14%) had hypertension [1(4%) & 6(24%) from cardiac center Rawalpindi & Lahore respectively], respectively and 2(4.0%) were smokers belong to PIC. Family history of head and neck malignancy as noted in none as shown in Table-I.

The mean duration of working in cardiac catheterization lab was 17.92±4.57 years. Among fifty Interventional cardiologists, only one Interventional

cardiologist had past or recent history of head and neck malignancy. The time from symptoms onset to treatment is 12 months. The duration of the treatment is 6 months. There was no Interventional Cardiologists' who had past or recent history of any other body organ malignancy (Table-II).

Table–I Demographics of Study Participants

Characteristics		n (%), Mean±SD		
		Institute-I n=25	Institute-II n=25	Overall n=50
Age (Years)		50.40±7.77	49.16±8.89	49.78±8.28
Gender	Male	25 (100%)	22(88.0%)	47(94.0%)
	Female	Nil	03(12.0%)	03(6.0%)
BMI (kg/m^2)		24.56±2.79	24.83±3.03	24.70±2.88
Diabetes Mellitus		Nil	03(12%)	03(6.0%)
Hypertension		1 (4.0%)	06(24.0%)	07(14.0%)
Smoker		Nil	02(8.0%)	02(4.0%)
Family History of Brain & Neck malignancy		Nil	Nil	Nil

Table-II Risk factors and diagnostic findings of study participants(n=50)

Findings / History		Institute-I	Institute-II	Overall	*p*-value
Duration of (No. of years) working in Cardiac Catheterization Labs		18.44± 4.13	17.40± 5.00	17.92± 4.57	0.602
Past or Recent history of Head and neck malignancy	Yes	01(4%)	-	01(2%)	0.306
	No	24(96%)	25(100%)		
Past or Recent Treatment history of Brain/Neck Malignancy	Yes	01(4%)	-	01(2%)	0.306
	No	24(96%)	25(100%)		
Past or Recent CT / MRI/PET scan of Brain and Neck Region	Yes	01(4%)	-	01(2%)	0.306
	No	24(96%)	25(100%)		
Scan more than or less than 5 years	Yes	01(4%)	-	01(2%)	0.306
	No	24(96%)	25(100%)		

The head and neck malignancy among Interventional Cardiologists 'was observed in 1 (2%) cases as shown in Figure.

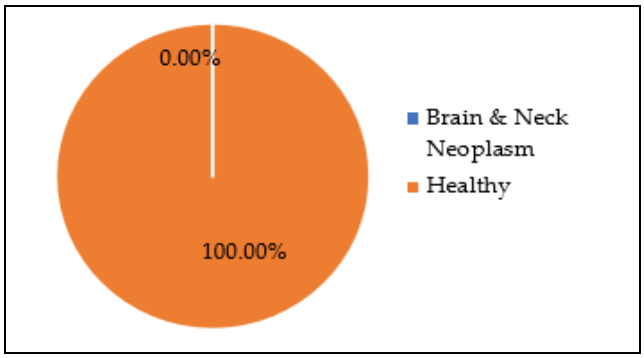

Figure: Distribution of head & neck malignancy among interventional cardiologists

DISSCUSSION

Percutaneous Coronary Intervention (PCI) has been preferred over coronary artery bypass grafting (CABG), as the coronary artery revascularization procedure in patients for the treatment of stable angina with multivessel coronary artery disease, and it is currently the standard of care in the majority of patients with single or two vessel coronary artery disease.[11] The treatment of acute coronary syndrome (ACS) has also been revolutionized in the last decade, with timely early coronary angiography and revascularization of ischemic myocardium by placing a stent in occluded coronary artery and hence in this way PCI reduce significant morbidity and mortality.[12,13]

One of the untold secrets of Interventional cardiology is that it has various occupational hazards. Despite having adequate protection, Interventional cardiologists are likely to encounter high doses of radiation, when performing PCI's or electrophysiology (EP) studies. This security comes at a cost.[14,15] The Interventional Cardiologist works in the cardiac catheterization labs, standing and wearing a lead for protection for long hours and it is done on a regular basis over a long period of time. As a consequence, people over the age of 40 years are more likely to have musculoskeletal disorders, such as aches and pains in the neck, back, hips, knees, and ankles, which can be mild to severe in intensity. Rest, physiotherapy and other conservative therapies help in relieving these orthopedic disorders.[16,17]

Interventional Cardiologists' working in the cardiac catheterization labs and doing PCI's frequently are exposed to high levels of radiation, which may increase their cancer risk as compared to those cardiologists who are not working in the catheterization labs.[18] In this study, it was observed that the mean duration of working in cardiac catheterization labs was 17.92±4.57 years. Among fifty Interventional cardiologists, only one Interventional cardiologist had past or recent history of head and neck malignancy. The time from symptoms onset to treatment is 12 months. The duration of the treatment is 6 months. There was no Interventional Cardiologists' who had past or recent history of any other body organ malignancy.

Medical x-ray and nuclear medicine exposure is the most common man-made source of radiation exposure, with a mean effective dosage of 1.0–3.0 mSv per person per year.[19] The Interventional cardiology procedures (both diagnostic and therapeutic) with a high radiation dose has been gradually increasing, as

has the global population's exposure to medical radiation.[20] Despite accounting for only 12% of all radiological tests, Interventional cardiac procedures are responsible for the highest radiation exposure (up to 50 percent of the total collective effective dose).[21] As a result of the rising workloads and complexity of treatments over the last decade, radiation exposure has become a major issue for Interventional cardiologists, Para-medics and as well as for patients.[22,23]

Ciraj-Bjelac has published a study on the risk of radiation-induced cataracts among Interventional cardiology professionals. The researchers had looked at the eyes of Interventional cardiologists, nurses, and age- and gender-matched unexposed controls and concluded that Interventional cardiologists and nurses, had a dose-dependent higher risk of posterior lens opacities. For interventional cardiologists, the relative risk of lens opacity was 5.7 (95% confidence interval: 1.5-22) and for nurses, it was 5.0 (95% confidence interval: 1.2-21). Occupational exposure and the prevalence of radiation-induced lens opacities were found to have a direct strong dose-response relationship.[24]

The researchers had discussed the two cases of Interventional Cardiologists' from Toronto, Canada, who were diagnosed with brain tumors (Glioblastomas) in the literature. Both worked at the University of Toronto, Canada and had been known as an outstanding physician in patient care, academic activities and research studies. One was in his early 60s and had spent many years at Toronto General Hospital as an Interventional cardiologist; the other was younger, in his early 50s, and had spent 20 years not just in the catheterization lab but also as a nuclear cardiologist. It took several months from the time of diagnosis to death.

Three physicians operating with fluoroscopy were mentioned in an article published in Sweden in 2001. Although all three had worked for some part with x-ray exposure, the latency periods were 20, 28, and 31 years in their case. Acoustic neuroma, meningioma, and oligodendrinoma were diagnosed, respectively. The authors computed an elevated risk of brain tumors in a physician's profession as (OR 6.00, 95 % CI: 0.62-57.7).[25]

In our study among fifty Interventional Cardiologists, only one had history of brain and neck malignancy and had undergone the successful treatment. This research study entrenched that radiation exposure of long duration among Interventional Cardiologist's while working in the cardiac catheterization labs, may lead to the occurrence of brain and neck malignancies. Therefore, this study highly recommends the implementation of SOP's regarding the proper use of radiation protective equipment among the Interventional Cardiologist's and as well as the other cardiac catheterization lab staff. The Interventional cardiologist's have to be more careful regarding their health and to undergo the medical examination annually.

LIMITATIONS OF STUDY

As the sample size was small, so the results cannot be generalized. Further studies should be done with large sample size and for prolonged periods of time to determine the possible risk factors that also contribute to the development of cancer among Interventional Cardiologists.

CONCLUSION

Hence the research study concluded 02 % prevalence of head and neck neoplasms among Interventional Cardiologists. But still it is the need of hour to be more careful about radiation exposure among Interventional Cardiologists' working for long hours in the cardiac catheterization labs to lessen down the chances of head and neck malignancy.

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Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MNT: Manuscript writing, drafting, study design & editing

NAS: Intellectual contribution, concept & final approval

MHR: Data collection, data entry and review of article

FT: Proof reading, Intellectual contribution, final approval

JA: Data collection, data entry and review of article

IA: Dat Data collection, data entry and review of article

MNK: Study design, concept & intellectual contribution

AN: Analysis, manuscript writing and proof reading

GC: Formatting, critical review and data collection/entry

SF: Study design, concept and critical review

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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