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Editorial

Need for structured patient education in improving treatment outcome in chronic lifelong diseases

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Incidence of chronic lifestyle related diseases is on the surge not only in Pakistan[1] but globally. Obesity and its associated comorbidities like heart disease, diabetes, stroke and other microvascular complications not only affect the patient's quality of life but also put a lot of economic burden both on the patient and healthcare sector.

These lifelong ailments do impact the patient and his family psychologically, as these diseases demand an altogether change in lifestyle of the patient. Changing a lifestyle pattern is not any different than changing a behavior or a bad habit and it demands a holistic multidisciplinary approach with emphasis on patient education.

Patient education is quite challenging once healthcare professionals are dealing with a wide range of patients, based on their educational backgrounds and having diverse mother languages. Further lack of availability of palatable information for patients in various languages further make it challenging for patients to grasp the real concept behind changing their behaviors. These challenges might breach patient doctor confidence and the patients turn to quacks, further aggravating their disease and related complications.

Changing behaviors with breached confidence with the doctor will make it impossible to convince an adult that his current lifestyle is posing a threat which can affect the quality of life. In this scenario a multidisciplinary approach by engaging a family physician, a psychologist and a nutritionist might help

the individual, however in a budget constraint healthcare sector the need of the hour is to educate the primary healthcare physician how to implement the behavioral change model in a personalized manner.

So to effectively educate the patients living with a chronic disease with a lot of variety in the follow up system once not a single general physician is designated to a fixed pool of patients, it's important to first educate the primary healthcare physicians, both doctors and nurses about the implementation of Prochaska model of behavioral therapy[2]. Health care individuals should be able to identify which phase of the behavioral model the patient currently belongs to base on history, ranging from contemplation, pre-contemplation, preparation, action, maintenance and relapse and further make a clear line of action to promote him up the stage to finally land in the maintenance phase.

It is recommended to share palatable information to the patients in the pre-contemplation phase, a phase where the individual don't recognizes that his current lifestyle poses any danger to his life, therefore is not open for any change, here argumentation will be of least help[3]. By employing the medical journalism and social media platform, it is needed that a simple, easily digestible information about the current disease of the patient, its associated complications along with treatment strategies should be made available to the patient along with the prescription. Since a lot of Latin language is already used on the social media

and it hasn't making any impact on changing the current unhealthy behaviors of the patients suffering from chronic lifelong diseases. So the need of the hour is to formulate a healthy dietary plan in the mother language of the patients and make it available at the time of consultation since it might have better impact on the patient education.

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Original Article

Open Access

Seroprevalence of Hepatitis B, Hepatitis C and Human Immunodeficiency Virus among volunteer blood donors in district Kech, Baluchistan: a cross-sectional study

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Abstract

Objective: The study aims to determine the seroprevalence percentage of Hepatitis B (HBV), Hepatitis C (HCV) and Human Immunodeficiency Virus (HIV) in volunteer donors of blood in district Kech.

Methods: The study was cross-sectional, conducted among volunteer blood donors presenting in donation camps in district Kech from May 2023 to September 2023, Kech thalassemia center screened for Hepatitis B, C and HIV using Rapid kit testing. A non-probability consecutive sampling technique was adopted. Data were analyzed using SPSS-26.

Results: The average age of study participants was 26.88 ± 8.24 years. Out of 512 donors, 511 (99.8%) were male and 259 (50.6%) were married. 112 (21.9%) donors were not formally educated 294 (57.4%) participants donated blood in the last year and 8 (1.6%) have received blood transfusion in the past. Among donors 6 (1.2%) screened positive for HBV, 2 (0.4%) screened positive for HCV and 2(0.4%) screened positive for HIV.

Conclusion: Blood Donors can be the source of transfusion-transmitted infections. Precautionary measures should be taken to minimize the spread of transfusion-transmitted infections.

Keywords: Prevalence, HBV, HCV HIV, Blood donors.

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Introduction

Blood is donated by voluntary donors of blood who come to blood centers and those who participate in camps conducted outside the blood centers. The most important treatment option for life-threatening conditions is blood transfusion.[1] It is also used for anemia and thalassemia major patients who rely on routine blood transfusions due to poor health conditions.[2] In Pakistan, approximately 1.5 million

transfusions are done yearly and around 3.5 million donations of blood are collected annually.[3] Blood donors worldwide collect over and beyond 112.5 million units of blood annually and 18 million or more units of blood are not screened for different infections that are transmitted by blood.[4]

Unsafe blood transfusion can be fatal due to transmission of blood-borne pathogens known as transfusion-transmissible infections (TTIs).[5] Various infections like HBV, HCV, and HIV which are the most frequent, can be spread via blood.[6] HIV and HBV are transmitted through standard modes, including blood-borne and vertical routes.[2] HBV and HCV are transmitted through various routes such as blood, sexual contact, and abrasions with contaminated sharp objects and from mother to child through vertical route.[7-8]

Hepatitis B and C are the two main causes of chronic liver disease, including chronic hepatitis, cirrhosis, and hepatocellular carcinoma (HCC).[9] HIV can affect immunity by decreasing the number of CD4 T Cells.[10] So it is important to decrease and prevent the TTIs in those patients who are at risk of infectious disease by multiple transfusion.[11]

In Pakistan, 150000 HBV and 250000 HCV are reported annually and globally HBV infects almost 350 million populations, HCV infects 200 million populations and HIV infects 38 million populations.[6-12] About 6.90% is suffering from HCV infection in Baluchistan.[8] Inadequately screened blood can be risk of transmitting blood-borne infections to the blood receivers.[12] The World Health Organization (WHO) argued screening donated blood for major TTIs to assure quality and safety.[5]

Due to lack of awareness and poor screening facilities, occurrence of TTIs is still a problem in our country. The occurrence of Hep B and C virus in Pakistan is the highest.[9] Due to the increased prevalence of TTIs and decreased awareness about screening in Pakistan, our current study is focused on finding the prevalence of hepatitis B, C and HIV among donors of blood. It also sought to raise awareness of these issues among the people of district Kech so that they could take precautions to lessen their risk of infections in the future.

Methodology

At donation camps, a cross-sectional study was conducted throughout district Kech, Balochistan from May 2023 to September 2023. The apparently healthy volunteer donors of blood were screened for HBV, HCV and HIV using rapid kit tests. The sample size was calculated to be 384 using OpenEpi with a 95% confidence level. The written consent was taken from all participants. Blood donors younger than 18 years, donors with anemia and malaria were excluded. The demographic profile details such as age, gender, marital status, level of education and history of previous donations, transfusion and deferral were taken from donor records using a structured questionnaire. Ethical approval was obtained from the ethical committee of MMC Turbat under ref.no MMC/ERC/2023/MAY/5. Blood was drawn from donors and rapid kit test was based on an immunochromatographic technique for detection of antibodies specific for HBV, HCV and HIV. The Data was entered on SPSS-26 for statistical analysis using simple descriptions such as frequencies and percentages.

Results

512 donors were contacted for blood donation and screened for TTIs. Out of 512 participants one was excluded. The mean age of donors was 26.88 ± 8.24 years. Among study participants (99.8%) were male, (50.6%) donors were married, (21.9%) donors were not formally educated. The monthly income of participants along with demographical details of donors is mentioned in. (Table 1)
(57.4%) participants have donated blood in the last year and only (1.6%) participants have received blood transfusion in the past.
Out of 512 donors, 6 (1.2%) were seropositive for HBV, 2 (0.4%) were positive for HCV and 2 (0.4%) tested positive for HIV. (Table-2)

Parameter		Frequency	Percentage
Gender	Male	511	99.8
	Female	1	0.2
Marital status	Single	253	49.4
	Married	259	50.6
Education Level	No formal Education	112	21.9
	Primary Education	73	14.3
	Secondary Education	117	22.9
	HSSC	105	20.5
	BS/BA	69	13.5
	MS/MA	33	6.4
	PhD	3	0.6
Monthly Income	10,000-20,000	114	22.3
	20,000-30,000	88	17.2
	30,000-40,000	57	11.1
	40,000-50,000	31	6.1
	50,000-60,000	18	3.5
	>60,000	49	9.6
	not mentioned	155	30.2
	Total	**512**	**100.0**

Table 1: Demographical details of study participants.

	Seropositive n (%)	Seronegative n (%)
HBV	6 (1.2%)	506(98.8%)
HCV **HIV**	2(0.4%)	510(99.6%)
	2(0.4%)	510(99.6%)

Table 2: Seroprevalence of HBV, HCV, and HIV.

HBV: Hepatitis B virus; HCV: Hepatitis C virus; HIV: Human Immunodeficiency virus

Discussion

Seroprevalence rates of the hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) in donors of blood revealed a significant public health challenge, requiring the urgent necessity for the implementation of public health interventions that specifically address these concerns. Studies have persistently revealed that the leading pathogens associated with transfusion-transmitted infections (TTIs) in Pakistan are notably the hepatitis C virus (HCV), the hepatitis B virus (HBV), and the human immunodeficiency virus (HIV), as reported by previous study.[13-14] It is noteworthy to mention that HCV has emerged as the most widely spread TTI in blood donors in Pakistan with documented rates oscillating between 1.5% to 3.82%, depending upon the parameters and methodologies applied in different studies.[13-15] The problem of HBV poses a public health danger with prevalence statistics between 1.08% to 1.7% among the donor community, which further emphasize the critical nature of these circumstances.[13-14] Understanding the demographic and genetic characteristics of donor populations, such as those documented in the Baloch ethnicity of Mekran Division, is essential for interpreting these prevalence patterns and developing targeted screening strategies.[15] While HIV is reported to be less prevalent in comparison to HCV and HBV, nevertheless it remains a crucial TTI with certain regions documenting seroprevalence rate of 0.15%, therefore highlighting the need for continued surveillance and intervention strategies to combat this virus.[13]

The majority of blood donations are derived from the alternate donors, who frequently do not undergo the rigorous screening processes consequently exacerbating the risk of transmission of TTIs.[13-14] Moreover, it has been observed that numerous blood transfusions centers are lacking in comprehensive and systemic screening protocols, resulting in elevated risk of transmitting TTIs.[16] The absence of centralized system for blood collection, coupled with inadequacy of sufficient screening assays, significantly contributes to the heightened risk of TTIs, thus demanding immediate actions[13,17].

Despite the troubling prevalence of TTIs in Pakistan, it is important to acknowledge that efforts to tackle these pressing challenges are underway. Strategic initiatives promoting refined screening methods and bolstering public health infrastructure are deemed essential component in the fight against TTIs in volunteer blood donation practices. It is vital to acknowledge that the effectiveness of government initiatives demands cooperation acres diverse areas to achieve real success and lasting impact.[13, 17]

The rate of seroconversion linked to TTI like HBV, HCV, and HIV show significant differences among groups considered high risks, especially individuals who undergo multiple blood transfusions. Recent studies have unveiled that individual with conditions like hemophilia, thalassemia are particularly at vulnerable to contracting TTIs.[18] A study has reported incredible 54.5% of hemophilia patients showed positive results for anti-HCV antibodies and 9.09% tested positive for HbsAg, with none showing signs and sero-indication of HIV.[18] In contrast among thalassemia patients the prevalence rate of HBV, HCV were both reported at 5%, further highlighting the ongoing risk of TTIs within these groups.[18]

A review reported the seroprevalnce figures among blood donors from India, HBV at 0.53%, HCV at 0.098%, and HIV at 0.08%.[19] another study conducted from 2004 to 2018 has shown ongoing threat of infections linked HBV, HCV, and HIV registering rates of 0.57%, 0.80%, and 0.035% donations respectively, with observable reduction in the incidence of these infections identified over the years.[20]

To combat these challenges associated with transfusion transferred HBV, HCV, and HIV a multi-factorial approach is needed. The strategies emphasize the enhancement of screening protocols, employment of advanced testing technologies, and establishment of rigorous donor selection processes to ensure the overall safety. The application of individual donor nucleic acid testing (id-NAT) has shown significant promise in improving the detection capabilities of viral infections by identifying pathogens during the critical window period, where traditional serological test may fails.[21-22] empirical studies have demonstrated that NAT can successfully identify the infections typically overlooked by serological test.[21] Implementation of combined immunoassays (IAs) enhances the sensitivity for identifying the early

infections due to the ability to detect antibodies as well as antigens simultaneously.[23] Furthermore adopting a sequential IAs approach is beneficial as it can improve the overall accuracy of screening by confirming the reactive results through implementing additional testing protocols.[23]

Careful selection of donors based on epidemiological data can minimize the occurrence of TTIs in donor population.[24] Continuous education and awareness about TTIs among healthcare providers and donors are crucial for improving blood safety.[24] These infections pose significant health risk, particularly in a country with a high prevalence of viral hepatitis and a healthcare system that faces challenges in ensuring safe blood transfusions. The prevalence of these infections in donors of blood highlights the ongoing threat they pose to public health. The risk factors associated with their transmission include inadequate screening processes, reliance on replacement donors and insufficient public health infrastructure. While these measures significantly enhance blood safety, challenges continue to exist, specifically in resource limited settings, where approaches to advance testing technologies may be confined. Balancing cost and safety is essential for optimizing transfusion practices globally.

Conclusion

Transfusion-Transmissible Disease infections were present among blood donors at District Kech Balochistan. Effective healthcare strategies should be implemented to minimize the spread of transfusion transmitted infections. More planning and methods are needed to increase screening in the population of district Kech, Baluchistan.

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Muhammad Wajid: Study design, data collection, and interpretation; writing of abstract, methodology, and results; final review of the manuscript; agree to be held accountable for all aspects of study.

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Attaullah: Study design; writing and revision of manuscript; final critical review and approval of the manuscript; agree to be held accountable for all aspects of study.

Noman Sadiq: Study design & data analysis; manuscript Drafting; final critical review and approval of the manuscript; agree to be held accountable for all aspects of study.

Original Article

Open Access

MRI based Morphometric analysis of tibial Plateau in Pakistani population: A cross sectional survey

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Abstract

Objective: Rationale of the study was to offer a basis for individualized implant/prosthesis adjustment, to assess the anthropometric data of the proximal tibial plateau in the Pakistani population using magnetic resonance imaging (MRI). Our hypothesis is that currently available tibial components in the market do not meet the requirements of our population and there is need of newly designed tibial component to match the needs of local population.

Methods: Magnetic resonance imaging is used to take anthropometric data from the proximal tibia. Data is taken from 121 knees (28 women and 93 men) in Pakistani subjects. Among the measured parameters were, "*Mediolateral, middle anteroposterior, medial and lateral anteroposterior dimensions and the aspect ratio of the resected proximaltibial surface*". All morphological data were compared with the dimensions of four contemporary tibial implants, including *asymmetric and symmetric design* types.

Results: The dimensions of the tibial plateau of Pakistani knees demonstrated significant differences in AP, ML, MAP, LAP, CM & CL according to gender ($P < 0.05$). Pearson coefficient correlation test revealed significant negative correlation (-0.7) between AR and AP dimension of tibial specimens irrespective of gender. However huge proportion of tibial implants this study tend to overhang or under hang mediolaterally.

Conclusion: We found that the morphological measurements of tibial components didn't match with the local tibial specimens, once compared with tibial components of commonly used TKR implants. Our data could provide the basis for designing the optimal tibial component for this population, required for best fit.

Keywords: *Total knee arthroplasty (TKA), total knee replacement (TKR), tibial plateau anthropometry, Tibial component, Magnetic resonance imaging (MRI)*

Introduction

The primary functions of the human lower limbs are movement and weight transmission. In addition to maintaining an erect, ambulatory standing position, these functional requirements have made the inferior extremities stronger and more stable. They have also changed the mechanical and functional requirements of all skeletal structures in comparison to the superior extremities[1].Humans may bear more weight when

their knees are extended. It is widely known how the anteroposterior and mediolateral dimensions of the main tibial sections relate to the various weight-bearing scenarios.[2] Knee injuries and arthritis are rather prevalent and are often treated with surgery. An in-depth anatomical research of this pertinent surgical sector would aid in the design of necessary interventions in a variety of pathological and degenerative disorders of the knee joint, as knee joint surgeries are technically challenging and quickly changing procedures.[3]

For severe knee osteoarthritis, knee arthroplasty is the recommended surgical option for pain alleviation and function restoration. A successful total knee arthroplasty (TKA) requires maximum tibial bone coverage with the right implant size, precision bone cutting, and proper soft tissue balancing.[4]

Direct and indirect approaches are typically employed for the morphometric analysis of knee joints. The direct method measures dry cadaveric bone with Vernier calipers and rulers. The indirect approach also makes use of three-dimensional (3D) models, magnetic resonance imaging (MRI), and computed tomography scans (CT) images. The benefit of the latter approach is that it is carried out digitally, which spares the specimen from damage. Additionally, we may obtain the patient's demographic information, which is not feasible when using dry cadaveric bones. Nowadays, morphometric studies of the knee joint frequently use 3D models.[5]

TKA usage is probably becoming more common in most populations worldwide.[6] However, currently no published information is available about proximal tibias anthropometric measurements for our population, and no research has assessed whether commercially available tibial components fully meet our population's needs. In order to offer a basis for individualized implant/prosthesis adjustment, the current study is directed to make a fair assessment of the proximal tibial plateaus anthropometric data from the Pakistani population by employing the magnetic resonance imaging (MRI).

Methodology

This is MRI based, retrospective, cross sectional descriptive study which was carried out in Iqbal Memorial Hospital Jhang in collaboration with Hitec Institute of Medical Sciences. All the patients who required MRI due to knee pain, uncertain history, and physical examination according to scientific indications with normal MRI report within the age range of 18-60 years were enrolled in the present study. Morphologic data from the proximal tibia of 121 knees (28 women and 93 men) were analyzed, wherein one knee of each subject was studied (left or right, as chosen randomly).

MRI Measurements

MRI images of each knee were obtained using a 0.3 Tesla Hitachi Airis 2 comfort. Knee was scanned after being relaxed and stabilized in the extended position in the leg holder with the subject in supine position. In order to reduce the chance of errors in measurement the leg holder is used to keep the leg in extended position throughout scanning, as limb rotations might affect the measurements.

MRI sections were taken in axial, coronal and sagittal planes through the resection level of proximal tibia and the epicondylar axis of the femur were obtained. Digital radiological system (Hitachi Airis 2 comfort) is employed to take simulated proximal tibial resections and then radiological measurements were taken virtually on each subject. Digital radiological system is used to get multislice images, further simulated resection levels and cutting thickness were determined, and the simulated axial slices were taken perpendicular to the mechanical axis of the tibia with a 7° posterior slope from 8 mm below the highest point of lateral tibial plateau (Fig.1).

Proximal tibial dimensions were measured using a standardized protocol. The ML and AP dimensions were taken for a selected slice to assess the gross size of proximal tibial surface. "The ML dimension is a line drawn in the axial plane to the tibial cut surface, which is parallel to the epicondylar axis of the femur and is the longest mediolateral distance of the proximal tibia" (Fig. 2) "It is formed by a line between the lateral epicondylar prominence and the medial sulcus of the medial epicondyle", as described by Karimi et al., 2019, according to which a set of morphological metrics were calculated as follows:[7]

Mediolateral (ML) width

The ML dimension was taken as the "longest ML width of the resected proximal tibial surface, drawn

parallel and collinear to the surgical epicondylar axis of the femur".

Anteroposterior (AP) length

"The AP dimension was taken as the length of a line drawn perpendicular and passing through the midpoint of the ML line."

Medial anteroposterior (MAP) and lateral anteroposterior (LAP)

"The MAP dimension and LAP dimension were defined as the longest lines drawn parallel to the AP line and perpendicular ML lines that connect the most anterior and the most posterior parts in the medial and lateral compartments in the resected tibial surface, respectively."

• Medial to center distance (CM) and lateral to center distance (CL): "The MAP and LAP distances to the central point are called CM and CL," respectively

• Aspect Ratio: The resected tibial plateau aspect ratio has been defined as "ML/AP ratio, and for each compartment (compartment aspect ratio) it has been calculated as MAP/ML and LAP/ML in the medial and lateral compartments, respectively."

All the measurements were recorded in millimeters using the "Hitachi imaging software version 5.0"
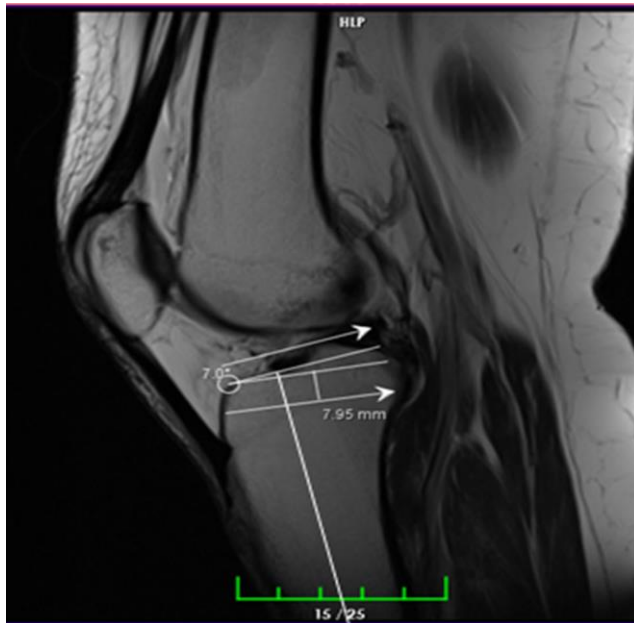
Fig 1: "MRI section in the sagittal plane used for drawing a 7° posteriorslope from 8 mm below the highest point of the lateral "tibial Plateau"
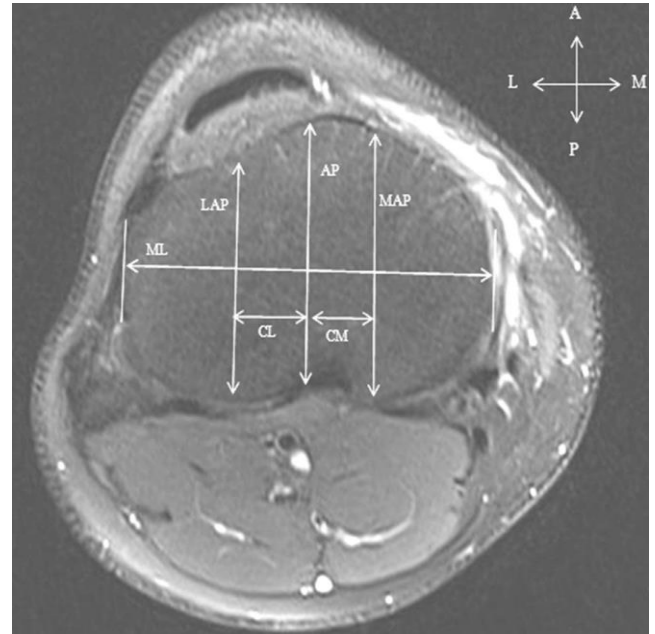
Fig 2: Schematic representation of the "proximal tibial" resected surface showing the measurement methods used in the MRI analysis.

Tibial component designs

"The symmetric tibial components of Zimmer, Nexgen, Biomet and Vanguard were used. The AP and ML dimensions of these components were obtained from the manufacturers, and all the available sizes of each component design were used in the analysis. According to the manufacturers' manuals, the medial or lateral AP diameters were taken into account for implants".

Statistical analysis

The data was statistically analyzed using SPSS software (version 28). Descriptive statistics were applied to measure the variables and age. In a comparison between the genders, the independent sample T test was performed. Person's correlation was recruited to study the correlation between simulated

bone cut and dimensions of prostheses used in TKA surgery. "P-value less than 0.05 was considered statistically significant."

Results

Gender based comparison was done within tibial specimens. Moreover, tibial specimens were compared tibial implants used for prosthesis.

Proximal Tibial measurement in study

Measurements of proximal tibial dimensions are summarized in Table 1. The mean scores of AP length and ML width, as well as the aspect ratio of tibial bone, in all subjects were 46.8±5.57mm, 74.0±5.06mm, and 1.60 ±0.33, respectively. The mean values of MAP and LAP were 49.9±3.9and 48.9±5.07 mm, respectively. AP, ML, MAP, LAP, CM & CL were significantly higher in males (P<0.05). Other ratios like ML/AP, MAP/ LAP, MAP/ML, and LAP/ML were non-significant between males and females. The distance of the MAP (CM) and LAP (CL) lines from the AP line was also taken into account, and MAP was found to be closer to the AP than LAP by an average of 0.5 mm in males and 0.7 mm in females which was not significant. These results confirm the symmetric shape of the proximal tibial surface at the resection level in the Pakistani population.

Table 1 "Average values of the measured data from the subjects"

parameters	male	female	total	P Value
	Mean ± SD			
Age (Yrs.)	34.61 ± 13.0	35.93±9.5	34.92±12.34	0.96
	Dimensions (mm)			
AP	48.2 ± 5.5	42.4± 2.7	46.8±5.57	<0.001
ML	75.8±4.0	67.8±2.6	74.0±5.06	<0.001
MAP	50.1± 3.5	45.1±2.4	49.9±3.9	<0.001
LAP	47.6±3.57	42.6±3.69	48.9±3.94	<0.001
CM	15.6±1.9	14.4±1.8	15.36±2.06	0.005
CL	15.8±1.9	14.5±2.1	15.56±2.06	0.002

Aspect Ratio				
ML/AP (AR)	1.6±0.3	1.6±0.1	1.60±0.33	0.9
MAL/LAP (AR-1)	1.0±0.06	1.0±0.04	1.01±0.06	0.8
MAP/ML (AR-2)	0.6±0.04	0.6±0.02	0.66±0.04	0.4
LAP/ML (AR-3)	0.6±0.04	0.6±0.03	0.66±0.04	0.7
MAP-LAP Diff	2.5±3.4	2.5±1.9	2.5±3.11	0.8

SD: standard deviation.
AR: Aspect Ratio

Comparison between Tibial specimens and implants

"For both genders, the AP sizes of all tibial implants tended to overhang or under hang for the given AP dimensions. In other words, the tibial components that matched properly with the AP dimension overhanged or underhanged mediolaterally. The comparisons of the dimensions of the tibial components and of the average tibial dimensions of males and females are shown in Figs 1 2 & 3. The data set of the study population was found to be relatively somewhat consistent with the dimensions of Biomet prostheses compared to others." No statistically significant difference was noted between the median ARs of females and males. However, the measurements demonstrated a progressive decline in the AR with an increase in the AP dimensions for both males and females (fig 4). Through the comparison of the tibial components, we found that all prostheses followed a similar horizontal pattern with a minimal decrease in the AR, irrespective of gender.

Correlation between AP diameter and proximal tibial aspect ratio of study population

Pearson coefficient correlation test revealed significant negative correlation (-0.7) which indicated that there is significant decrease in AR with increase in AP size irrespective of gender. The shapes of tibial specimens illustrating a progressive decrease in AR with an increasing AP dimension are shown in Fig. 4.

Correlation between proximal Tibial components of study population with Tibial implants

Pearson coefficient correlation test was performed to find the correlation between proximal tibial measurements among the Pakistani population and tibial prostheses. A non-significant positive correlation was found between AP diameters of tibial specimens & NexGen (0.36) and Zimmer (0.50). However, ML diameters of tibial specimens revealed non-significant positive correlation with those of Venguard (0.36). Moreover, when this test was applied on overall aspect ratios it revealed a non-significant positive correlation between aspect ratios of Tibial Specimens and Biomet (0.52).
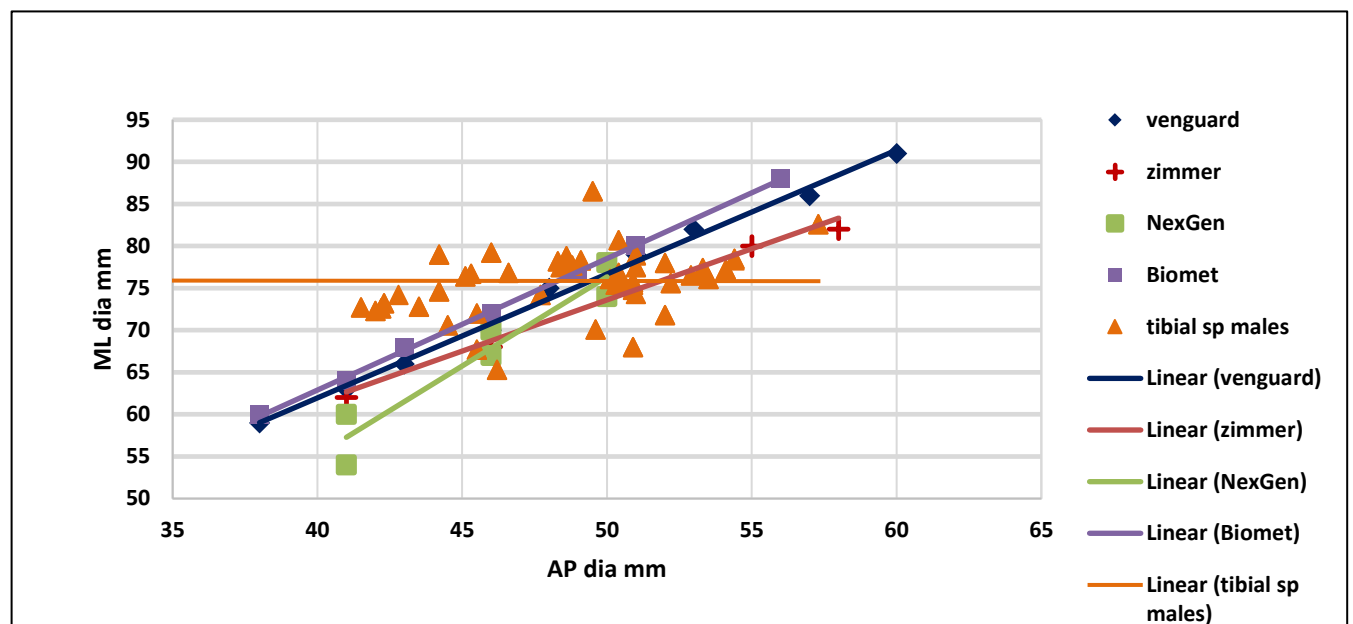
Fig 1: "Proximal tibial ML and AP dimensions of male subjects compared with the dimensions in four conventional tibial prostheses. This graphic demonstrates that tibial components tended to be small or large for Pakistani males for a given AP dimension. Among these prostheses, Venguard design followed the population data most consistently compared to the others".
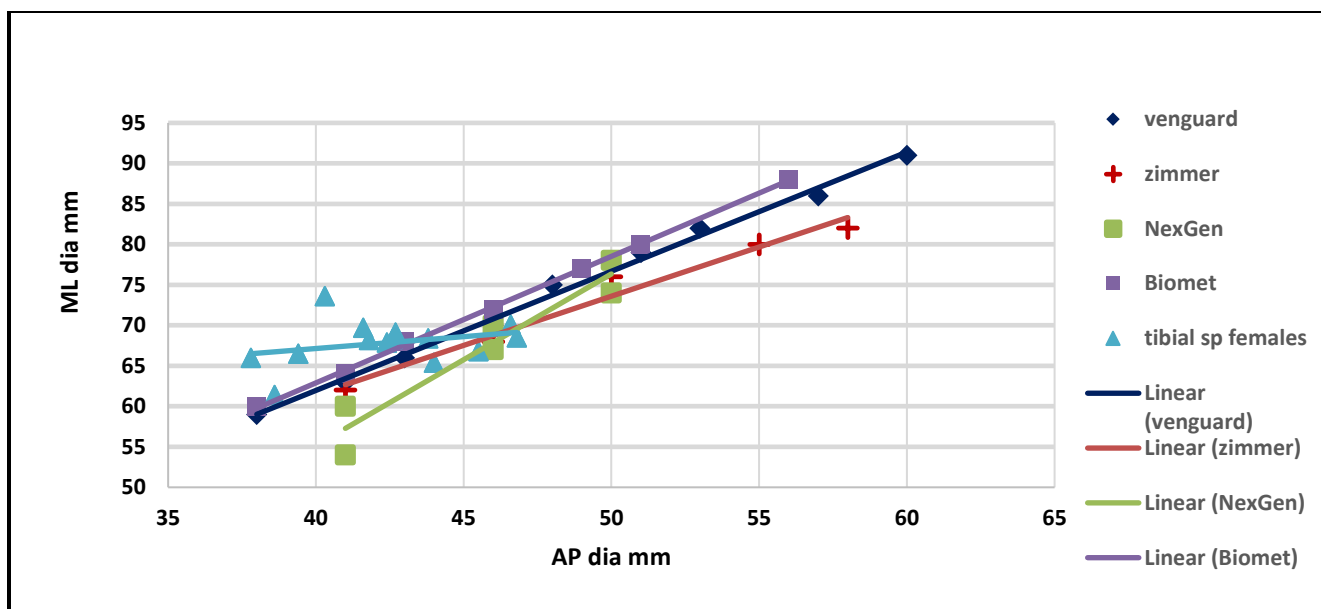
Fig 2: "Proximal tibial ML and AP dimensions of female subjects compared with the dimensions in four conventional tibial prostheses. This graphic demonstrates that tibial components tended to be too small or too large for Pakistani females for a given AP dimension."
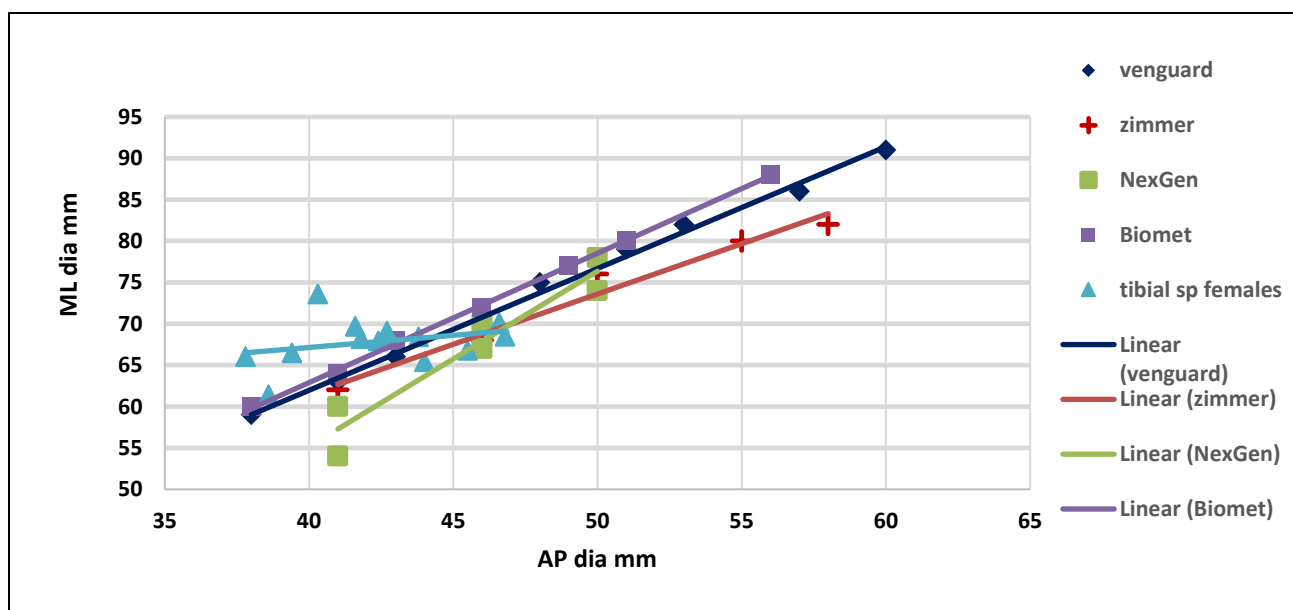
Fig 3. Correlations of resected tibial mediolateral width and anteroposterior length in 121 knees of study population in comparison with dimensions in four current tibial prostheses.
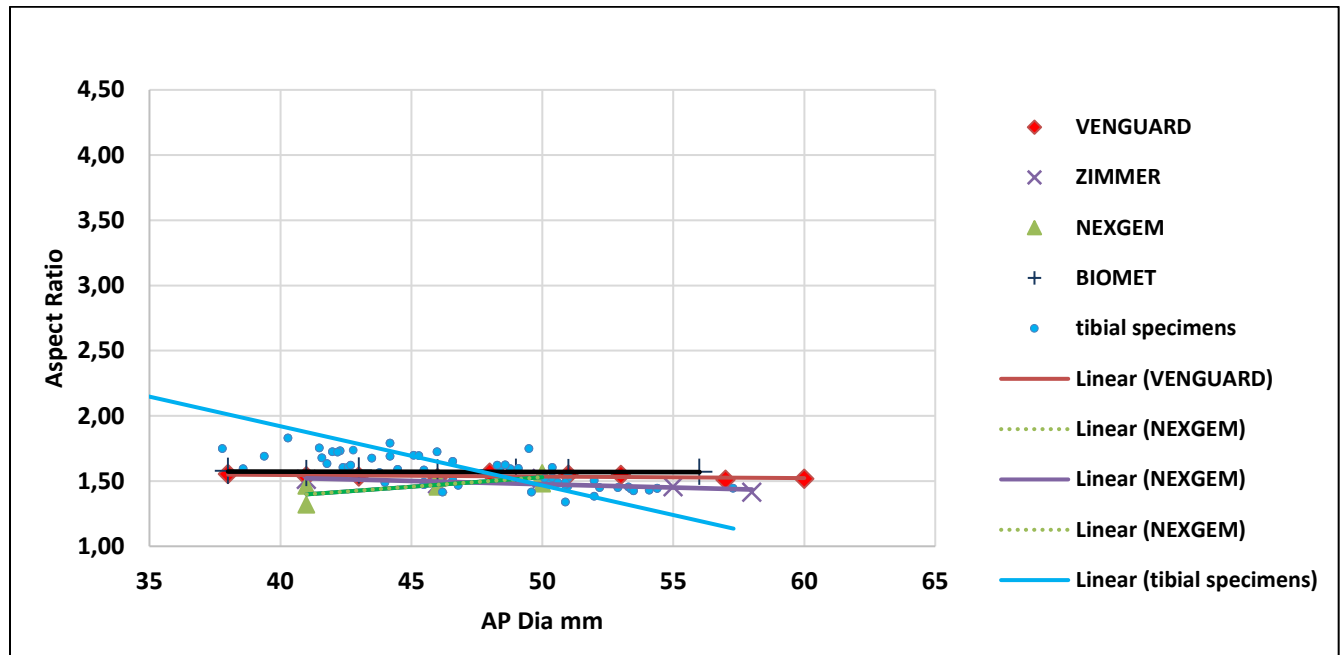
Fig 4 "Proximal tibial aspect ratio and the AP dimension of tibial specimens compared with the dimensions of four conventional tibial prostheses. The line represents the median values for the population. The population data show a significant decrease in the aspect ratio with the increasing AP size of the knee,(significant negative correlation -0.7) whereas most of the prostheses show a relatively constant aspect ratio."

SD: standard deviation.

Aspect ratios of the specimens and various implants

Specimen/implant	Average aspect ratio
Tibial specimens	1.58
Zimmer	1.48
NexGen	1.47
Biomet	1.57
Venguard	1.53

Discussion

Researchers should look for ways to increase the prosthesis' durability and retention because TKA is on the rise. Creating prosthetics that fit the anthropometry of any population is one of these techniques. Most of the components are made to conform to the physical characteristics of Westerners. Furthermore, the findings of several research show that Asian and Western societies differ in the morphological and anatomical traits of the lower limbs[5]. While the physique and size of Pakistanis are comparable to those of other Asians.[8] However, there are anthropometric variations within

this population. Numerous studies have examined Asian knee morphology and contrasted it with Chinese and Western knees.[9,10,11] To the best of our knowledge, this is the first report on the anthropometry of the proximal tibia in the Pakistani population. Data on this subject have not yet been published. This investigation produced a number of conclusions.

Women's proximal tibial anatomic forms and dimensions were smaller than those of men, according to the research population's measurements. This discrepancy is consistent with earlier reports and was anticipated.[7,12] Comparing our measurement data with previously published data revealed that the AP and ML lengths were almost identical to those of the Turkish[7] and Thai populations[5], but smaller than those of the Western population. The ML length of Chinese males and females was estimated by Zhang et al., 2019 to be 75.59 ± 2.8 mm and 62.89 ± 2.77 mm, respectively, which corresponded to 75.8 ± 4.0 mm and 67.8 ± 2.6 mm in our study[11]. The majority of women in this study (20 of 28) had AP diameters between 41 and 47 mm, while the majority of men (60 of 93) had AP diameters between 47 and 58 mm. Given that 80% of knees fall within this range, the ML dimensions of the tibial component should concentrate on a length of 66–70 mm for women and 71–80 mm for males. This indicates that a tibial component that varies in size between 66 and 80 mm in ML length and 41 and 58 mm in AP length is appropriate for most of the Pakistani population.

 A vital factor that affects joint stability, range of motion, and implant design is aspect ratio, which is calculated by dividing mediolateral width (ML) by anteroposterior length (AP).[13] According to Zang et al. (2019), the Northeast Chinese male and female populations had ML/AP ratios of 1.71 and 1.77, respectively.[11] In our population, there was no gender variance (p = 0.9), despite the fact that the same index for Caucasian males and females was 1.75 and 1.76. Additionally, our study's aspect ratio (1.60) was lower than that of our Chinese and Caucasian counterparts.[14,15]

At first, it was determined that a larger knee had a reduced aspect ratio. Though the aspect ratio of the tibia plateau may not be enough to direct the design of tibial prostheses, it could be used as a reference given the larger knee size and higher aspect ratio of the Caucasian population.[3, 15, 16]

The symmetry of the proximal tibial cut was examined in this study in order to align the geometry of the tibial prosthesis's components with the bone surface. The average LAP and MAP measurements were 48.70 ± 5.35 mm and 50.12 ± 4.88 mm, respectively. Moreover, the study population had asymmetric proximal tibia, as evidenced by the mean CL and CM scores of 17.09 ± 6.83 and 13.40 ± 6.17 mm, respectively. The majority of the commonly available complete knee implants have symmetric tibial baseplates, despite the fact that certain authors have suggested that asymmetric tibial components will fit better in the bone surface.[7,17,18]

However, certain studies have shown that, in comparison to the usage of asymmetric tibial base plates, the symmetric component's tibial coating was better because the tibial plateau was more widely covered.[19] However, despite the fact that an asymmetric tibial component seems to be advantageous in theory for optimizing tibial surface coverage, there has been no convincing proof of the functional benefit of utilizing asymmetric components.[20] According to recent research, the amount of tibial bone covering offered by symmetric and asymmetric base plate designs was comparable.[21, 13]

As the AP size increased, the aspect ratio of the tibial specimens in the present study gradually decreased. In contrast, the majority of prostheses exhibit a comparatively constant aspect ratio as the AP dimension increases, which causes oversizing issues with the proximal tibia's growing AP dimensions in this population. Our current data indicates that certain biomet designs fit the proximal tibia better than others as the aspect ratio of our tibial specimen is close to that of biomet designs.[22]

The tibial AR of the majority of the implants used for comparison was lower than the aspect ratio (AR=ML/AP) of the current study group. Additionally, this suggests that the sizes of the implants utilized in the study did not match the proximal tibial morphology (for a given AP length, the implants' ML dimension was less than the knee's ML diameter), which could result in undercoverage. This indicates that the four prosthesis stated above do not meet the needs of this group and are currently on the market.

Our study showed that the aspect ratio of Pakistani population having asymmetrical tibial base plates is greater than the aspect ratio of most of knee models which are used in total knee arthroplasty. This is in accordance with the findings mentioned by Singh et al., 2016[19].

Conclusion

Pakistanis have proximal tibia dimensions that are different from those of other populations. The majority of the implants' dimensions did not closely match those of the local tibia specimens, according to a comparison with tibial components of commonly used TKR implants.

Recommendations:

1. The results may not be applicable to patients with degenerative arthritis who are candidates for total knee arthroplasty (TKA), as the participants in this study were relatively young and had healthy knees. Therefore, future research in Pakistan should include a more balanced sample, consisting of both younger and older individuals, to provide more relevant insights.

2. Since height and weight were not analyzed as separate factors in the proximal tibia measurements in this study, additional research is needed to investigate how these variables might influence the findings.

CONFLICT Of INTEREST: None.

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Authors Contribution:

Dr Iram Zakria: Substantial contributions to study design, acquisition of data; manuscript writing; has given final approval of the version to be published;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.

Dr. Maleeha Zafar: Substantial contributions to study design, acquisition of data; manuscript writing;has given final approval of the version to be published; 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.

Dr Rabia Waseem: Substantial contributions to analysis and interpretation of data; critical review; has given final approval of the version to be published ;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.

Dr Salma Ambreen Shahab: Substantial contributions to concept, study design ; critical review; has given final approval of the version to be published; 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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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.

Original Article

Self-medication of Anxiolytics, Antidepressants, and Psychoactive Stimulants amongst Students of HITEC-IMS Taxila: A Cross-Sectional Study

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Abstract

Background: Self-medication is one of the major issues faced by the Physicians as it can complicate the current illness in addition to the associated risk factors associated with polypharmacy. Students initiate antidepressants on their own in the start in order to better cope up with the studies and exam related stress, however non supervised use for a longer duration can put them at higher risk of addiction.

Objective: To determine the frequency, reasons of self-medication of Anxiolytics, Antidepressants, and Psychoactive Stimulants and to see the association of self-medication with demographic characteristics among medical and dental students of HITEC-IMS Taxila.

Methods: A cross-sectional study was conducted at HITEC-IMS and Dental College, Taxila, from June to August 2022. A sample size of 250 was calculated by the Open Epi calculator from a total population of 700 with a 50% anticipated frequency, a 95% confidence interval, and a 5% chance. Convenience sampling was adopted for taking the samples of medical and dental students. Data was collected manually by a structured Performa and analyzed by SPSS version 25.

Results: A total of 250 students were included in the study. 86.8% were medical students, and 13.2% were from dental colleges. Out of 250 students, 79 (31.6%) were taking psychoactive stimulants. Out of the 79 students who were using these medicines, the frequency of self-medication was 40 (50.6%), but 39 (49.9%) were using them with a proper prescription. Gender showed a significant association with self-medication (p-value 0.01).

Conclusion: Counselling and mentoring regarding stress coping strategies should be part of undergraduate training rather than self-medication of psychostimulants.

Keywords: Academic pressure, antidepressants, psychoactive stimulants, pharmacy students, self-medication.

Introduction

The term self-medication is defined as "*over-the-counter use of medicines by patients on the basis of their own perceptions and thoughts, without taking any guidance from a health professional*". Different factors responsible for self-medication are easy accessibility and availability of these medicines, reluctance to consult a health care professional, and

the offer of a surplus of prescription drugs by friends and relatives.[1]

There has been an alarming rise in psychological distress among college and university students globally over the past decade, negatively affecting multiple domains of their lives. In response, the use of psychoactive stimulants is increasing steadily.[2] "Brain doping," "academic performance enhancement," "pharmacological neuro enhancement, and cognitive enhancement" are different names used for the psychoactive stimulants. They are mainly categorized as different psychoactive substances that are used without prescription for the purpose of increasing alertness, attention, focus, or memory by healthy individuals.[3]

The students studying in medical universities have easy access to information from many resources e.g. drug indices, literature on Medscape and pubmed, and other friends to diagnose and treat themselves.[4] Antidepressants are commonly used among students for treating anxiety and study-related stress.[1,5] Students get into the trap of using self-prescribed psychoactive stimulants in order to enhance their academic performance[6.] Other incentives for the misuse of prescription- only drugs among students comprise improving academic grades, mental health problems such as sleep disturbance, sports outcome or the management of some already existing diseases.[2]

The rate of self-medication is particularly significant for the South Asian countries; however the trend is less common in Europe and other developed countries, where strict legalization make it impossible to buy these medications without a doctor's prescription[7]. A recent survey conducted of university students in Pakistan showed the prevalence of self-medication to be 76% in Karachi and 41% in Islamabad, which is alarming and should be considered for making some policy and devising regulatory interventions. Majority reported study stress as a reason for antidepressant use, and more than half of the students reported for enhancing performance.[1] A study from 12 cities in Pakistan showed widespread use of antidepressants with a prevalence of 8.34 (8.03–8.85 for 95% CI), and consumption of psychoactive stimulants was obvious among the students in their final year, with a prevalence of 1.31 (1.13–1.75 for 95% CI).[6]

It is particularly concerning that an increasing number of students are engaging in excessive use of prescription-only psychoactive stimulants, facilitated by their easy accessibility through unregistered pharmacies in our country. To date, no prior study has been conducted at HITEC-IMS to address this emerging issue. Therefore, we undertook this research to determine the frequency of self-medication involving anxiolytics, antidepressants, and psychoactive stimulants, and to identify the underlying factors contributing to their use among medical and dental students at HITEC-IMS. This study can help the administration devise a plan for early detection, implementing stress-coping interventions by involving the mentors and psychologists.

Objectives:

1. Determine the frequency of self-administration of anxiolytics, antidepressants, and psychoactive stimulants among medical and dental undergrad students
2. Identify the factors driving the self-administration of anxiolytics, antidepressants, and psychoactive stimulants.
3. Investigate the relationship of self-medication with variables such as gender, age, living situation, and academic year of the students.

Methodology

It's a descriptive cross-sectional study conducted at HITEC-IMS & HITEC-Dental College from June to August 2022 after taking the ethical approval from the HITEC-IMS ethical review board #HITEC-IMS-14-2022.

The calculated sample size was 250, calculated by an open EPI calculator with a 95% confidence interval and a 5% chance. The total population taken under study was 700, and the anticipated frequency was 50%. Non-probability, Convenience sampling. Among the Inclusion criteria are the Medical and dental students of HITEC-IMS, who gave informed consent. Students migrated from any other institute during the last six months and who were absent at the time of data collection were excluded.

Data were collected by using a proforma developed after reviewing literature from articles with similar objectives. Data were collected after verbal informed consent and responses were recorded 1. It was validated by the relevant faculty. The Performa

consisted of 3 sections. The first section included demographic characteristics like age, gender, year of study, and residential status. The second section included whether they had any awareness and use of psychoactive stimulants and antidepressants. The third section was about the reasons for using anxiolytics, antidepressants, and psychoactive stimulants. Data were analyzed by employing SPSS version 25.

Analysis of categorical variables includes percentages and frequencies. The relationship of anxiolytics, anti-depressants, and psychoactive stimulants with age, gender, living status, and year of study was investigated by applying the Chi-square test of significance and taking the pre-determined α value of 0.05.

Results

This survey was conducted among medical and dental undergrad students of HITEC-IMS Taxila to determine the frequency of self-medication of anxiolytics, antidepressants, and psychoactive stimulants. A total of 250 students from the medical and dental colleges participated in the study. The demographic details of the participants are given below in Table 1.

Table 1: Sociodemographic statistics of Participants		
Variables	**Frequency(n)**	**Percentage (%)**
Gender		
Male	71	28.4
Female	179	71.6
Age in years		
<25	36	14.4
20-25	196	78.4
>25	18	7.2
Living status		
Hostel lite	147	58.8
Day scholar	103	41.2

Family setup		
Nuclear	184	73.6
Joint	66	26.4
Course of the study		
Medical	**217**	**86.8**
Dental	33	13.2
Total	250	100

Out of 250 students, 186 (74.4%) were aware of the use of psychoactive stimulants, and 197 (78.8%) were aware of anxiolytics and antidepressants. Of the total participants, 79(31.6%) were using these medicines, and 171(68.5%) were not using any of these medicines. It was found that percentage of the students using antidepressants was greater than the students using stimulant. Results related to the use of different types of medicines are depicted in fig 1.

Results of the study showed that the use of self-medication is more prevalent among female students 29 (60%) than male students 10 (32%), It was further assessed that 40(50.6%) students were using these medicines without any prescription, and 39(49.9%) were using them on the advice of their physician. On enquiring about the frequency of use of these medicines, 25(31.6%) were using them frequently, and 54 (68.4%) were using them on demand.
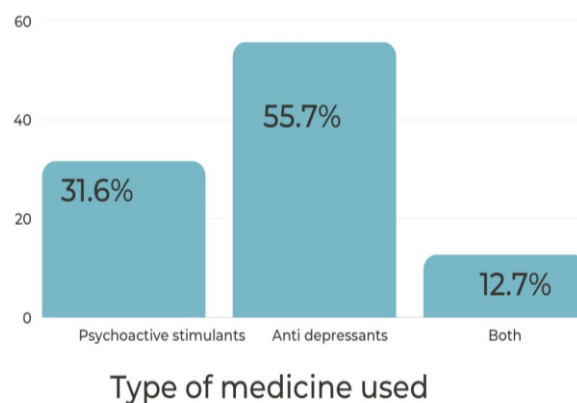

Fig 1: Frequency of Use of anxiolytics, antidepressants and psychoactive stimulants.

Fig 2 depicts the results of reasons identified by the students for using these medicines. Study stress was

identified as a major factor leading to the use of these medicines while peer pressure, and family issues were not reported as a major concern.
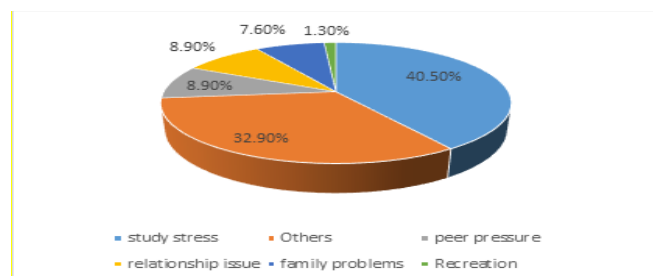

Fig 2: Reasons for using psychoactive stimulants, anxiolytics and anti-depressants.

Self-medication was found to be more common among females as compared to males (p-value 0.01), but no significant association of age, living situation and academic year of student was found with self-medication of these drugs. Detailed results are given below in table 2.

Table 2: Association of self-medication with demographic characteristics.

Demographic characteristic	Self-medication		p-value
	Yes	No	
Gender Male	10(32%)	21(68%)	**0.01***
Female	29(60%)	19(40%)	
Age (years) <20	6(43%)	8(57%)	0.8
20-25	30(51%)	2949%)	
>25	3(50%)	3(50%)	
Living status Hostelites	22(47%)	25(53%)	0.6
Dayscholars	17(53%)	15(47%)	
Academic year Preclinical			
Clinical	14(52%)	13(48%)	0.8

	25(48%)	27(52%)

Discussion

The practice of self-medication is widespread all over the world, especially among urban and educated populations. Doctors also tend to self-medicate to the extent feasible. Due to their knowledge about both diseases and drugs.[8] This study was conducted on the 250 medical and dental students of HITEC-IMS, to sheds light on the sensitive aspects of self-medication of anxiolytics, antidepressants, antidepressants and psychoactive stimulants among them. Study stress, peer pressure, relationship issues, and family problems were observed among the most common reasons for self-medication. Self-medication was found statistically associated with gender (p-value 0.01), but no statistically significant association was observed with age (p= 0.8), living situation (p= 0.5) and academic year of student (p= 0.6).

Out of 250 participants, 186 (74.4%) reported awareness of psychoactive stimulants, while 197 (78.8%) were familiar with anxiolytics and antidepressants. however, only 79(31.6%) indicated actual use of these medications. This prevalence is markedly lower compared to similar studies conducted in Mangalore (92%)[5], Nigeria (81%)[8], South India (92%)[3], Bangladesh (100%)[9], and Brazil (86.4%).[10] The comparatively low rate of self-medication in our study may be attributed to stronger familial and peer support systems, as well as heightened awareness of the potential adverse effects associated with psychoactive drug use. Students may also underreport usage due to stigma surrounding mental health and psychoactive drug use, especially in academic settings. Results of the study showed that the use of self-medication is more prevalent among female students 29 (60%) than male students 10 (32%), similar to the results of an online survey in Germany,[4] Nigeria[8], Brazil[11] and Gujrat.[12] In contrary to our result, study conducted in Iran[13], showed high prevalence of self-medication among male students (65.4%).

In our study, 32% of participants reported using the substances due to academic stress, 8.9% cited peer pressure, 7.6% mentioned relationship issues, and 32.9% attributed their use to family problems or other unspecified reasons. Only one student reported

recreational use. In contrast, a similar study found that the majority used these substances to enhance cognitive performance.[5] Notably, over half of the students in our sample (50.6%) who were using antidepressants and psychoactive stimulants did not have any diagnosed psychiatric disorder. These findings are consistent with a German study[4], which reported that pharmacological neuroenhancer use was more prevalent among healthy individuals.

Approximately 63% of the students are engaged in self-prescribing the psychoactive stimulants, owing to increasing academic pressure, however 96% of students used antidepressants without consulting a physician to obtain relief from the pressure of studies,[1] but in KSA[7], long waiting list in the hospitals for specialist consultation and a lack of time to visit the hospital were the main factors that resulted in increased reliance of students on self-prescribed antidepressants and psychoactive drugs. For most students, the major reason for using self-medication was taking the illness less seriously in Gondar, Ethiopia.[14] Self-medication practice is becoming popular as the people have knowledge, previous experience, minor illness and it also saves money, time and relieves stress.[15]

A majority of students (63%) identified academic competition as the primary driver for self-medicating with psychoactive stimulants, while nearly all (96%) reported using antidepressants to alleviate study-related stress.[1] In contrast, a study conducted in the Kingdom of Saudi Arabia (KSA)[7] found that self-medication was largely attributed to long hospital queues and limited time to seek medical care. In Gondar, Ethiopia[14], most students cited a tendency to take illnesses less seriously as the main reason for self-medication.

Overall, the practice of self-medication is gaining popularity, driven by individuals' prior knowledge, previous experiences, and the perception that minor illnesses do not warrant professional consultation. It is also viewed as a means to save time and money, and to reduce stress.[15] Majority participants 64(81%) in our study were aware of the harmful effects, these findings are similar to research conducted across twelve cities of Pakistan[1], where despite the awareness of negative outcome of psychoactive stimulants, students continued to indulged in self-medication.

Our study showed significant association with gender, which is similar to study in Nigeria.[8] In contrary to that no statistical association found with gender in another study conducted in Karachi, Pakistan.[16]

Conclusion

The self-medication of stimulants, anxiolytics, and antidepressants attributed to study stress is alarming among medical and dental students. Counselling and mentoring regarding stress coping strategies should be part of undergraduate training.

Limitations

The main limitation are convenience sampling, single center and the inability to identify causation due to the cross-sectional nature of the data collection. There is possibility that lot of students did not provided us the right information as depression and associated psychiatric ailments are considered as a taboo in the society.

Recommendations

There is dire need to raise early awareness among the students about the adverse effects and associated drawbacks with the inappropriate use of antidepressants and psychoactive stimulants. Since good habits are being formed at school age, school curriculum should be revised to further enlighten students. Finally legislation may also be needed to stop and strictly punish the unauthorized vendors of psychoactive stimulants and antidepressants.

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Original Article

Open Access

Experiences of Continuous Glucose Monitoring Systems in Patients of Type1 Diabetes Mellitus;

Intermittently Scanned vs Real Time Device

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Abstract

Objective: The present study was designed to get evidence-based data for assessing the effectiveness of real-time (rt) or intermittently scanned (is) CGM sensors and comparing their burdens and benefits among patients of type 1 diabetes mellitus (T1DM) in our setup.

Method: A cross-sectional study with nonprobability convenience sampling was performed from July 2023-December 2023 on all the patients and parents of patients with TIDM, on insulin therapy enrolled with Meethi Zindagi. With ethical consent, a validated questionnaire was filled out by participants. Burdens and benefits of technology were assessed in isCGM and rtCGM users.

Results: Of the 53 participants, 34 were male and 19 female. A total of 41 were isCGM users, whereas 12 were using rtCGM. Levels of HbA1c were significantly lower in the rtCGM group (*p* value=0.015). As compared to the isCGM group, the percentage of rtCGM users having <7% HbA1c was more (84%) with a significant *p-value* of 0.005. Comparing CGM benefits in terms of item agreement, 100% of all rtCGM users agreed to easy "diabetes care" and "management of hypoglycemia". Regarding "less fingerpicks" and "feeling of security" majority (91.7%, 75%) of rtCGM users were in favor. The majority of the participants of both groups found CGM devices expensive; 28 out of 41 in the case of rtCGM and 8 out of 12 of isCGM users.

Conclusion: This analysis highlights the encouraging benefits of rtCGM for better glycemic outcomes in the population with T1DM. The data supports the significance of real-time sensors for easy care of diabetes and management of hypoglycemia, providing guidance to clinicians while discussing one-to-one care preferences with their patients. Support for making it more cost-effective, as well as working out to address specific hurdles are needed to grow technology.

Keywords: Continuous glucose monitoring, intermittently scanned CGM, real-time CGM, and type 1 diabetes mellitus.

Introduction

Prevalence of diabetes is continuously increasing globally; it is anticipated that by 2040 more than 700 million people will be suffering from this disorder.[1] by 2040, the number of prevalent cases is projected to rise to between 13.5 and 17.4 million, representing a 60% to 107% increase compared to 2021. The most significant relative growth is expected in low-income and lower-middle-income countries.[2] Recent data collected in Pakistan reported the incidence of T1DM 1.02 per 100,000 per year.[3]

The continuous glucose monitoring (CGM) system has taken an important place in the management of T1DM. This system is capable of replacing the disadvantages or problems faced by routinely used portable glucose meters along with test strips and lancets at home.[4] CGM technology is nearly replacing self-management of blood glucose (SMBG) in patients with diabetes taking insulin therapy. [5]

Abundant obtainable data is establishing the advantages of CGM in patients with diabetes, in terms of HbA1c reduction, less hypoglycemic events and diabetes-related stress with an overall improvement in life quality.[6] CGM systems come in the form of either real-time (rt) or intermittently scanned (is) CGM, both types are shown to have benefits.[6]

Around 1.5 million people are using isCGM worldwide[7], which transfers the data on a reader or smartphone by scanning the sensor manually. With this device, the user has to put extra effort into scanning the sensor by hand. More recent research highlights the positive effects of isCGM use in diabetes management by reducing hypoglycemia and improving long-term glucose control.[8]

In the case of rtCGM, data is automatically transmitted to a smartphone.[9] rt-CGM device supports patients and clinicians in identifying blood glucose trends, making it easier to modify diets, manage insulin doses, and drive the individual for physical activity.[10] Better control of glucose levels with rt CGM is seen as compared to isCGM.[9] Recent evidence proves the greater effectiveness of rtCGM compared to isCGM in reducing the time of hypoglycemia and increasing the time in range with improved HbA1c levels in patients with T1DM.[11] It helps in the easy management of T1DM with an increased sense of safety, however, operating the device has been found challenging.[6]

We have already determined the significant effect of the overall CGM devices on glycemic control in T1DM patients12. Thus there is a need to explore the experiences of different types of CGM technology among patients of T1DM for better diabetes care in our set-up. It will also help healthcare professionals (HCPs) to choose which type of CGM device can benefit their patients in diabetes management. For this purpose, the present study was designed to get evidence-based data through a validated questionnaire for assessing the effectiveness of isCGM and rtCGM and comparing their burdens and benefits.

Methodology

This research work was ratified by the Ethical Committee of the HITEC-Institute of Medical Sciences, Taxila. It was a cross-sectional study with nonprobability convenience sampling. All patients of T1DM of all age groups, enrolled with Meethi Zindagi (MZ), on insulin therapy, and using isCGM (Free Style Libre 1) or rtCGM devices were included in the study. HbA1c data was collected from patients using a Google Form. Individuals with any other type of diabetes were excluded. The total number of enrolled patients who met the inclusion criteria during the study period was 53. The usefulness and weaknesses of the CGM systems were evaluated using a validated questionnaire 13 via the MZ platform. The questionnaire depicts 8 items for benefits and burdens each. To rate each item, 1 describes strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree. A higher mean score shows the participant's agreement with the item. Parents were asked to fill out the questionnaire in case of patients less than 12 years of age. Data was collected in six months, from July - December 2023. The participants were divided into two groups; isCGM and rtCGM users.

Statistical analysis was done with SPSS software (version 25.0.0.2, 2018). For quantitative variables, mean and standard deviation (SD) and for categorical data, numbers and percentages were calculated. The chi-square and independent sample t-test were used for the comparison of variables in both groups. The association of variables was determined by the Spearmen correlation. P value ≤0.05 was considered statistically significant.

Results

Of the 53 participants, 34 were male and 19 were female. A total of 41 were isCGM users, whereas 12 were using rtCGM. Levels of HbA1c were significantly lower in the rtCGM group (p value=0.015), a significantly higher proportion of rtCGM users achieved HbA1c <7% (84%) compared to isCGM users (p = 0.005). Characteristics of participants including gender, age, duration of diabetes and physical activity between both group's isCGM and rtCGM were statistically the same. (Table 1).

Almost all participants agree with the benefits of CGM use. (Table 2A).

Comparing CGM benefits in terms of item agreement, 100% of rtCGM users agreed to easy "diabetes care" and "management of hypoglycemia" in contrast to the isCGM group where few were neutral. Regarding "fewer fingerpricks" and "feeling of security" in contrast to the isCGM group, majority (91.7%, 75%) of rtCGM users were in favor. (Table 2B).

When looking at the average scores for how participants perceived the burden of using CGM, most either agreed or disagreed with the statements. However, when it came to the cost of the device, most participants were either neutral or agreed. The average score was 3.68 ± 1.46 for isCGM users and 3.83 ± 1.47 for rtCGM users, with no significant difference between them (p = 0.75). Sensor technology was found equally burdensome due to both types' high cost. There was no statistically significant difference was noted between the two groups except item "painful to wear" showing 2.12 ±1.005 with isCGM while 1.42 ±0.90 with rtCGM (p = 0.03). Here difference was only evident between disagreed and strongly disagreed. (Table 3A).

When comparing burdens in terms of item agreement, majority of the participants of both groups found CGM device expensive; 28 out of 41 in case of rtCGM and 8 out of 12 of isCGM users. While analyzing the statement, "readings not trusted", majority of the isCGM users did not agree while few were neutral or agreed. In contrast, in rtCGM group equal number of participants were neutral or showed disagreement. Main stream of the participants of both groups opposed the statement that sensor was not helpful. (Table 3B).

Table 1—Baseline characteristics of participants

Variables	isCGM (n=41)	rtCGM (n=12)	P-value
Male; n (%)	29(71)	5(42)	0.09
Female; n (%)	12(29)	7(58)	
Age, years; median (IQR)	10(6.0 – 19.5)	13(9 – 34)	0.28
Duration of diabetes, years ; median (IQR)	4 (2-7)	4 (2 -17.75)	0.39
Physical activity; n (%)			
Mild	14(34)	4(33)	0.98
Moderate	21(51)	6(50)	
Strenuous	6(15)	2(17)	
HbA1c levels			
Mean±SD	7.28±0.80	6.63±0.73	0.015
HbA1c; n (%)			
<7%	13(32)	10(84)	0.005
7-8%	23(56)	01(8)	
>8%	05(12)	01(8)	

Table 2A—Benefits of CGM use: Mean Scores.

CGM Type	Diabetes care easier	*P*-value	Alarms are helpful	*P*-value	Less Finger-sticks	*P*-value	Helps with low blood sugar	*P*-value	Feel more secure	*P*-value	Family wants	*P*-value	Diabetes care better	*P*-value	Helps during exercise	*P*-value
isCGM (n=41)	4.34 ±0.62	0.97	3.39 ±1.05	0.59	4.05 ±0.97	0.50	4.24 ±0.58	0.974	4.02 ±.91	0.63	3.98 ±0.79	0.38	4.10 ±0.89	0.62	3.29 ±1.01	0.89
rtCGM (n=12)	4.33 ±0.49		3.58 ±1.17		4.25 ±0.62		4.25 ±0.45		4.17 ±.84		3.75 ±0.75		4.25 ±1.06		3.25 ±0.87	

Table 2B—Benefits of CGM Use: Item Agreement.

CGM Type	Frequency (%)	Diabetes care easier	Alarms are helpful	Less fingersticks	Helps with low blood sugar	Feel more secure	Family wants	Diabetes care better	Helps during exercise
isCGM (n=41)	Strongly agree	17(41.5)	9(22)	17(41.5)	13(31.7)	14(34.1)	12(29.3)	15(36.6)	7(17.1)
	Agree	21(51.2)	6(14.6)	12(29.3)	25(61.0)	17(41.5)	16(39)	18(43.9)	7(17.1)
	Neutral	3(7.3)	18(43.9)	9(22)	3(7.3)	7(17.1)	13(31.7)	5(12.2)	18(43.9)
	Disagree	0	8(19.5)	3(7.3)	0	3(7.3)	0	3(7.3)	9(22.0)
	Strongly disagree	0	0	0	0	0	0	0	0
rtCGM (n=12)	Strongly agree	4(33.3)	4(33.3)	4(33.3)	3(25)	5(41.7)	2(16.7)	7(58.3)	2(16.7)
	Agree	8(66.7)	1(8.3)	7(58.4)	9(75)	4(33.3)	5(41.7)	2(16.7)	0
	Neutral	0	5(41.7)	1(8.3)	0	3(25)	5(41.7)	2(16.7)	9(75)
	Disagree	0	2(16.7)	0	0	0	0	1(8.3)	1(8.3)
	Strongly disagree	0	0	0	0	0	0	0	0

Table 3A—Burdens of CGM Use: Mean Scores.

CGM Type	Too costly	*P*-value	Painful to wear	*P*-value	Readings not trusted	*P*-value	Too much time to use	*P*-value	Not helpful	*P*-value	Cause worry	*P*-value	Embarrassed wearing	*P*-value	Hard to under-stand	*P*-value
isCGM (n=41)	3.68 ±1.457	0.75	2.12 ±1.005	0.03	2.10 ±0.86	0.59	1.90 ±0.80	0.96	1.59 ±0.74	0.16	2.12 ±0.98	0.08	1.90 ±0.80	0.13	1.90 ±0.80	0.24
rtCGM (n=12)	3.83 ±1.47		1.42 ±0.90		2.25 ±0.87		1.92 ±1.08		1.25 ±0.62		1.58 ±0.67		1.50 ±0.79		1.58 ±0.90	

Table 3B—Burdens of CGM Use: Item Agreement

	Frequency (%)CGM	Too costly	Painful to wear	Readings not trusted	Too much time to use	Not helpful	Cause worry	Embarrassed wearing	Hard to understand
isCGM (n=41)	Strongly agree	16(39)	0	0	0	0Type	0	0	0
	Agree	12(29.3)	3(7.3)	3(7.3)	2(4.9)	0	4(9.8)	1(2.4)	1(2.5)
	Neutral	3(7.3)	14(34.1)	8(19.5)	5(12.2)	6(14.6	10(24.4)	8(19.5)	8(19.5)
	Disagree	4(9.8)	9(22)	20(48.8)	21(51.2)	12(29.3)	14(34.1)	18(43.9)	18(44)
	Strongly disagree	6(14.6)	15(36.6)	10(24.4)	13(31.7)	23(56.1)	13(31.7)	14(34.1)	14(34.1)
rtCGM (n=12)	Strongly agree	6(50)	0	0	0	0	0	0	0
	Agree	2(16.7)	1(8.3)	0	1(8.3)	0	0	0	1(8.4)
	Neutral	1(8.3)	0	6(50)	3(25.0)	1(8.3)	1(8.3)	2(16.6)	0
	Disagree	2(16.7)	2(16.7)	3(25)	2(16.7)	1(8.3)	5(41.7)	2(16.7)	4(33.3)
	Strongly disagree	1(8.3)	9(75)	3(25)	6(50.0)	10(83.3)	6(50)	8(66.7)	7(58.3)

Discussion

CGM technology has professed barriers or benefits conferring to the experiences of individuals with T1DM.[14] Choice of the CGM, recommended by The National Institute for Health and Care Excellence (NICE), is according to the individual's requirements and preferences, and the availability of the devices.[15] For that purpose, the present study explored the perceptions of CGM technology in T1DM patients of all age groups.

Demographically the larger study population was <13 years of age, had a higher female %age, better HbA1c, and longer duration of diabetes in individuals who were rtCGM users as compared to isCGM. Similar results were reported by Brown RE et.al.[16] Among isCGM users of our study, the majority were young adults parallel to findings of previous data; where 88% of the study population was younger individuals using isCGM sensors.[17]

Our major concern was comparing the impact of both devices on glycemic control. There was a noticeable difference in HbA1c levels in both the groups; <7% of HbA1c level was found in the majority of rtCGM users as compared to those wearing intermittently scanned sensors in parallel to a recent analysis that demonstrated the role of different types of devices in improving HbA1c and advocated the superiority of real-time sensors over isCGM.[9] Study states that the presence of an alert system and real-time readings of blood glucose levels are the reasons for better glycemic control with rtCGM[9] Another study on isCGM users showed that patients transitioned to rtCGM for better diabetes management and achieved improved outcomes with fewer low blood sugar episodes and more stable glucose levels.[11]

Our data validates the better life quality with the use of either technology, including all age groups. A survey, regardless of any specific age supports that sensor technology may improve quality of life, increase feelings of safety, and self-reliance in diabetes management and, stress-free everyday life.[18] A Dutch analysis of adults with T1DM using rtCGM highlights less anxiety with better physical and emotional health in these individuals.10 Youngsters describe easy insulin dose and diet management, upkeeping sports activities and diabetes care in school and outside, with the use of rtCGM.[19]

Increased risk of hypoglycemia especially at night is a common problem in the pediatric age group of T1DM patients.[11] Our users' satisfaction was almost equal with both devices; nearly all the participants agreed that CGM helps with low blood sugar. Conversely, Zhou Y et al illustrate more satisfaction with rtCGM and found it a safer choice for individuals facing nocturnal hypoglycemia.[20] Similarly another study shares the comparison of sensors in children and establishes a remarkable reduction of hypoglycemia in rtCGM users.[21] Although both systems are clinically acceptable, the real-time device is more promising than isCGM, however, the aptness of the systems depends on individuals' requirements and choices.[22]

The presence of alerts and continuous blood glucose data in rtCGM enables patients to timely address the low or high blood sugar, especially after meals and exercise, observing good glycemic control.[23] Moreover, keeping the blood sugar most of the time within range is also possible with this alarm system.[24] Real-time CGM was found superior over the first generation isCGM that lacks an alert system.[11] Contrariwise, sensor alarms may be bothersome for some individuals as experienced in our study. Likewise, previous data emphasizes alarm fatigue and distress in children and their families using CGM technology.[18] Alarm exhaustion with rtCGM needs to be addressed distinctly. The alarm feature is missing in isCGM (Free Style Libre 1) used in this study. The new FreeStyle Libre 2 system is more accurate and efficient with an alert system for better glycemic control.[25] We were not able to figure out the number of patients using either version of isCGMs. This may be the reason for neutral results with the statement, "alarms are helpful".

Concerned families and parents of T1DM children when involved in diabetes care may find it a hefty burden. Our participants who wore a device when "family wants" supported to reduce caregivers' burnout. Families recount the benefits of CGM for easy diabetes management, reduced worries about hypoglycemia and generalized emotional well-being in individuals with T1DM.[26]

Regarding exercise management with CGM, users of both devices yielded similar answers; the majority were neutral. However, 22% of isCGM users did not agree with the statement. Contrasting experiences of rtCGM users were described, finding the device helpful in correcting upcoming hypoglycemia during exercise,[23] recommending rtCGM use in young patients involved in regular workouts. A lack of awareness about the device may be the reason for our neutral results.

Data exploring the adoption of digital health technology (DHT) including CGM among diabetic patients in Pakistan showed that gender differences, varied education and income levels highlight how socioeconomic factors affect its implementation. Sixty percent cited cost as the primary issue. However, 97% expressed willingness to adopt DHT, indicating strong growth potential if affordability

was addressed. Cultural resistance was low, but lack of government support remained a significant challenge for widespread adoption.[27]

A small percentage of our study participants showed some other undesirable effects of both devices including wear-related concerns, life incursions, mistrust of readings, and idealistic anticipations. Such types of problems described as psychosocial impediments associated with diabetes technology were also seen in the adult population of diabetes.[18] CGM is certainly the impending technology in management of T1DM. It is approaching to have enhanced glucose control and reduced burden of care in these patients,[23] making a U-turn in diabetes care with a healthier quality of life.[13] Increased facilitation to make the best use of different kinds of CGM sensors and to curtail their related problems is also needed. Trained clinicians can make appropriate patient selections based on individual needs and preferences to achieve maximum benefit from this technology.[23]

Real time CGM is found superior to isCGM mainly because it provides continuous real-time glucose data with alerts for high or low levels, allowing users to take immediate action and maintain better glycemic control. Users who actively respond to these alerts tend to achieve improved outcomes. However, in low-resource settings, the high cost, limited availability, lack of trained healthcare support, and socioeconomic factors pose significant barriers to rtCGM adoption. Overcoming these challenges through subsidies, education, and improved healthcare infrastructure is essential to make this technology accessible and effective for all patients.

Limitations: The major limitation was the small sample size which may be insufficient to draw inferences for some quantitative assessments.

Conclusion

This analysis highlights the encouraging benefits of rtCGM for better glycemic outcomes in the population with T1DM. The data supports the significance of real-time sensors for easy care of diabetes and the management of hypoglycemia. These findings provide substantial guidance to clinicians while discussing one-to-one care preferences with their patients. Support for making it more cost-effective and insurance coverage, as well as working out to address specific hurdles are needed to grow CGM technology.

Recommendations:

- A multicenter large-scale study should be conducted
- Regional education and support in multiple languages/formats should be offered to understand the CGM use.
- Training programs should be conducted to improve digital skills and guide CGM usage.
- User-friendly tools should be developed to ease CGM usage.
- Feedback mechanisms should be set up (surveys, focus groups, user reviews) for ongoing input.

CONFLICT Of INTEREST: None.

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Challenges and Opportunities in Lung Cancer Screening in Pakistan: Bridging the Gap in Early Detection and Care

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Abstract

Lung cancer remains one of the leading causes of cancer-related mortality globally, with its burden rising in low- and middle-income countries like Pakistan. Despite being among the five most common cancers in the country, accurate data on lung cancer incidence are limited due to underreporting and inadequate cancer registries. Smoking, air pollution, and biomass fuel use are key risk factors contributing to its prevalence. Early detection through low-dose computed tomography (LDCT) screening has been shown to reduce lung cancer mortality significantly, as evidenced by international studies like the NELSON trial.

However, Pakistan faces significant barriers to implementing such screening programs, including insufficient CT scanner availability, a shortage of trained healthcare personnel, and logistical challenges. Furthermore, the high prevalence of lung infections, particularly tuberculosis, increases the likelihood of false positives during screenings, adding complexity to diagnostic efforts.

Integrating smoking cessation counseling into screening programs and cost-effective diagnostic techniques like CT-guided biopsies could enhance the overall impact of lung cancer screening. Additionally, advancements in artificial intelligence offer opportunities to alleviate the workload of radiologists, although these technologies require further development for reliable automated evaluations.

While infrastructural and resource limitations hinder immediate implementation, addressing these gaps could make lung cancer screening a vital tool in combating the disease's growing burden in Pakistan.

Keywords: Computed Tomography, Lung Cancer Screening, Pakistan

The Epidemiology of Lung Cancer in Pakistan

Lung cancer is one of the deadliest forms of cancer worldwide, and its burden is increasing in low- and middle-income countries like Pakistan. Over the past decades, lung cancer has emerged as a significant public health challenge in Pakistan, driven by rising smoking rates among both men and women, as well as exposure to other risk factors such as air pollution and the use of biomass fuels for cooking and heating. This underscores the urgent need for effective strategies for early detection and treatment of lung cancer.

Lung cancer is among the five most common cancers in Pakistan, with a distinct gender disparity showing higher incidence among men than women. According to data from Globocan 2020, the incidence of lung cancer is rising and is projected to increase to 19140 cases by 2040.[1] However, these figures may be underreported due to inadequate cancer registries and the lack of a robust healthcare surveillance system, which means that not all cases of lung cancer are documented. This adds to the challenge of understanding the true burden of the disease in Pakistan.[2]

Smoking is the primary risk factor for lung cancer in Pakistan, with approximately 19% of the adult population identified as smokers, including a growing trend among youth.[2] Other significant risk factors include passive smoking, exposure to industrial pollutants, and the widespread use of charcoal, wood, and other biomass fuels in households.[3] Air pollution is also a major concern, particularly in urban areas such as Karachi, Lahore, and Islamabad, where PM2.5 levels frequently exceed the recommended limits set by the World Health Organization.[4]

CT Scanner Capacity in Pakistan

One of the critical barriers to implementing widespread lung cancer screening in Pakistan is the insufficient number of CT scanners across the country. There is limited recent data published on the number of CT scanners available in Pakistan, however it is significantly lower than the availability in developed countries.[5] This limited capacity makes it challenging to conduct low-dose computed tomography (LDCT) screenings, especially in rural and underserved areas.

Most CT scanners are concentrated in large urban centers, such as Karachi, Lahore, and Islamabad, leaving a significant portion of the population without access to advanced diagnostic tools. Additionally, many healthcare facilities lack trained personnel to operate these machines and interpret the results effectively.[5] This shortage underscores the need for investment in diagnostic infrastructure and capacity building to enable impartial access to lung cancer screening services.

Expanding CT scanner availability and ensuring their optimal use will require coordinated efforts from both the public and private sectors. Partnerships with international organizations and donor agencies could help fund the procurement of additional scanners and support training programs for healthcare professionals. Establishing mobile diagnostic units equipped with CT scanners could also improve access in remote areas.

Insights from the NELSON Study

The NELSON study, a landmark randomized controlled trial conducted in Europe, provided compelling evidence for the effectiveness of LDCT screening in reducing lung cancer mortality. The study demonstrated a 24% reduction in lung cancer-related deaths among men and an even higher reduction of up to 33% in women who underwent LDCT screening compared to those who did not.[6] These findings underscore the potential of LDCT screening in identifying lung cancer at an earlier and more treatable stage.

In both Europe and the United States, implementation studies are now underway to explore how lung cancer screening can be integrated into healthcare systems. These studies aim to address practical challenges such as participant recruitment, follow-up protocols, and management of incidental findings. One notable example is the TIDL study in Norway, which focuses on optimizing the screening process to ensure its feasibility and effectiveness in real-world settings.[7] Such initiatives provide valuable insights that could inform the development of tailored screening programs in Pakistan.

The NELSON study also emphasized the importance of a structured screening program with well-defined protocols for participant selection, follow-up, and management of findings. Lessons from this study and implementation studies in other countries could inform the development of similar programs in Pakistan,

adapted to local epidemiological and resource constraints. However, implementing such programs in Pakistan would require overcoming significant logistical and infrastructural barriers, including improving CT scanner capacity and training healthcare personnel.

The Importance of Early Detection

Early detection of lung cancer can significantly reduce mortality by enabling faster and more effective treatment. Screening for lung cancer using low-dose computed tomography (LDCT) has been recommended as an effective method for early diagnosis in high-risk populations, such as smokers and former smokers. High-risk individuals are typically identified based on factors such as age, smoking history, and cumulative smoking exposure measured in pack-years. Risk calculators like the PLCOm2012 model are increasingly being used to refine risk assessment, ensuring that those most likely to benefit from screening are identified.[8]

Additionally, LDCT screening offers an opportunity to detect other smoking-related diseases, such as chronic obstructive pulmonary disease (COPD) and ischemic heart disease, which are also major contributors to morbidity and mortality in Pakistan.[9]

Early detection through LDCT screening can also prove to be cost-effective in the long run. When lung cancer is identified at an early stage, patients are often eligible for minimally invasive surgical interventions, such as video-assisted thoracoscopic surgery (VATS)[10], which is less resource-intensive and has a shorter recovery period compared to traditional surgery. Moreover, early-stage diagnosis reduces the need for expensive treatments like chemotherapy and immunotherapy, which are typically required for advanced stages of cancer. By enabling curative treatment options at an earlier phase, screening not only improves survival rates but also reduces the overall economic burden on healthcare systems and patients.[11,12]

The Importance of Smoking Cessation Counseling

Integrating smoking cessation counseling into lung cancer screening programs is essential, as continued smoking not only increases the risk of developing lung cancer but also worsens outcomes for those already diagnosed. Studies from the Danish Lung Cancer Screening Trial (DLCST) have shown that providing smoking cessation counseling during screening appointments significantly improves quit rates among participants [12].

Screening appointments offer a unique opportunity to engage with individuals who are at high risk and often motivated to make lifestyle changes. Counseling sessions can be tailored to address the specific needs of participants, providing them with personalized advice, nicotine replacement therapy, and resources to quit smoking. Implementing structured smoking cessation programs as part of screening can enhance the overall effectiveness of lung cancer control efforts by addressing both prevention and early detection simultaneously.

CT-Guided Lung Biopsies in Pakistan

CT-guided lung biopsies are an essential diagnostic tool in the early detection and management of lung cancer. This minimally invasive procedure allows for the precise collection of tissue samples from lung nodules, even those as small as a few millimeters, enabling accurate pathological diagnosis. CT-guided biopsies are considered relatively safe, with low complication rates compared to other methods, making them a preferred choice for obtaining tissue from suspicious nodules identified during screenings [13].

In Pakistan, the availability and utilization of CT-guided lung biopsies are limited due to infrastructural constraints and a shortage of trained radiologists. Most facilities capable of performing CT-guided biopsies are located in major urban centers, leaving patients in rural areas without access to this critical diagnostic service. Additionally, the high cost of the procedure and lack of insurance coverage further restrict access for a significant portion of the population. Expanding the availability of CT-guided biopsy services and training more healthcare professionals in this technique could significantly enhance the diagnostic capabilities for lung cancer in Pakistan, enabling earlier and more accurate detection.

A Norwegian study emphasized the importance of capacity. Their findings highlight the need for practical training workshops and knowledge

transfer initiatives to empower local healthcare providers in adopting advanced diagnostic techniques, such as CT-guided biopsies.[13]These measures are crucial for improving early diagnostic rates and facilitating effective treatment planning for lung cancer patients in Pakistan.

The Challenge of High Incidence of Lung Infections

Pakistan has a high incidence of lung infections, particularly tuberculosis (TB), which poses a significant challenge for lung cancer screening programs. Tuberculosis shares many radiological features with lung cancer, such as nodules and masses visible on CT scans, which increases the risk of false-positive results during screening.[14] This overlap can lead to unnecessary biopsies, anxiety for patients, and additional costs for the healthcare system.

Moreover, the prevalence of TB in Pakistan is among the highest globally, with over 500,000 new cases reported annually.[15] The co-existence of TB and lung cancer further complicates diagnosis, as individuals with TB are also at an elevated risk of developing lung cancer due to chronic inflammation and scarring in lung tissues. Addressing this issue will require integrating TB control efforts with lung cancer screening initiatives, as well as investing in advanced diagnostic tools that can differentiate between these conditions more accurately.

Challenges and Opportunities

While there are significant challenges associated with lung cancer screening in Pakistan, there is also potential for progress. Public health campaigns can play a pivotal role in reducing smoking and exposure to other risk factors. Additionally, international collaborations and donor programs can help fund screening initiatives and build capacity within the healthcare sector.

Technological advancements and increased access to digital health platforms can also enhance detection and follow-up of lung cancer. Mobile applications and telemedicine can be leveraged to reach patients in remote areas, providing information on symptoms, screening, and treatment options. Artificial intelligence (AI) tools hold promise in reducing the workload of radiologists by identifying cancer-suspect nodules on CT scans. However, these technologies are not yet fully developed for automated evaluation of CT images, requiring further research and validation.[16]. At the same time, investment in training healthcare professionals and establishing regional centers for early diagnostics can contribute to improving the situation.

Conclusion

Lung cancer poses a growing health burden in Pakistan, and there is an urgent need to implement strategies for early detection and treatment. However, the significant challenges in terms of limited CT scanner capacity and shortage of trained healthcare professionals make widespread implementation of screening programs difficult in the short term. Addressing these infrastructural barriers is critical to ensure the feasibility and sustainability of such initiatives.

If these challenges can be overcome through strategic investments and collaborations, lung cancer screening could play a pivotal role in reducing the burden of the disease in Pakistan. Given the high prevalence of lung cancer and its associated mortality, early detection through LDCT screening has the potential to significantly improve patient outcomes and reduce the economic impact of the disease on the healthcare system.

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Authors Contribution:

Haseem Ashraf: Conceptualized the study, critically evaluated the literature, written the manuscript and proof read it, agree to be held accountable for all aspects of study.