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EDITORIAL

Can Community-Based Health Insurance (CBHI) Initiatives Serve as Sustainable Healthcare Financing Mechanism in Resource-Poor Settings?

Muhammad Adnan Khan

COMMUNITY-BASED HEALTH INSURANCE

Health has a leading impact on the country´s economic development and in this aspect, quality health care financing is a significant challenge especially for developing countries.[1] Healthcare financing relies on general taxation or mandated health insurance in most of the high-income countries as in the United Kingdom, France and Germany. On the other hand, low-income countries lack a tax-funded health system.[2]

Community-based health insurance (CBHI) is an emerging concept that provides financial resources for health care and improves access to quality health services. It was introduced in West Africa in 1990 for the financial protection of the poor and rural countries.[1,3] The development agencies are increasingly considering CBHI as a tool that enables easy access to quality health care and reduces absolute poverty among low-income populations.[1] The CBHI scheme is any system which is operated and managed by an organization, other than a private or government company, that provides risk pooling to cover part or all of the expenditure of healthcare services.[4] There are several forms of CBHI like micro-insurance schemes, mutual health organizations and medical aid societies.[5] Community-based health insurance financing has different types. These include insurance sponsored by the private hospital who cover their own hospital-based facilities, NGO-sponsored insurance and insurance by private providers.[3] The CBHI works by risks pooling and is financed by regular premiums.[6] Globally, CBHI has been widely implemented in developing countries such as India, Ghana, China, Rwanda and Burkina Faso.[3] Ghana and Rwanda were the first countries that used CBHI for healthcare financing.[7]

Community-based health insurance has evolved from a 3 step model. This model was developed by Wang and Pielemeier in 2012. These models are the generic model, enhanced model and nationwide model. In the generic model, the CBHI scheme is started and managed by the community. It is small with voluntary membership and has no legal or government support. In the enhanced model, the CBHI is supported by the government. The communication between different schemes and the delivery of healthcare services improves in this model. In the third nationwide model, the scheme has nationwide coverage with powerful legislative regulations and funding (Figure 2).[7]

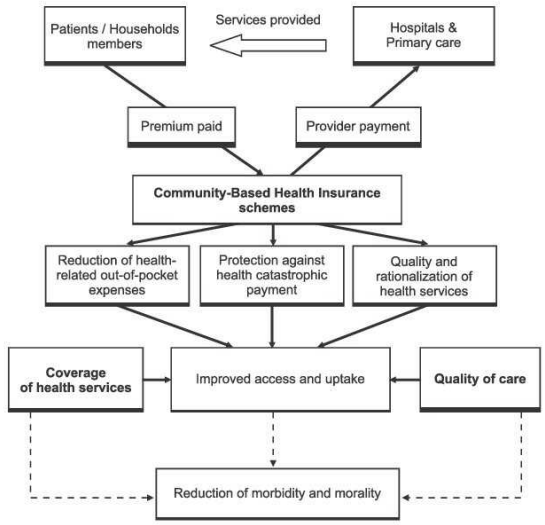

Figure 1: "Community-Based Health Insurance Framework"[8]

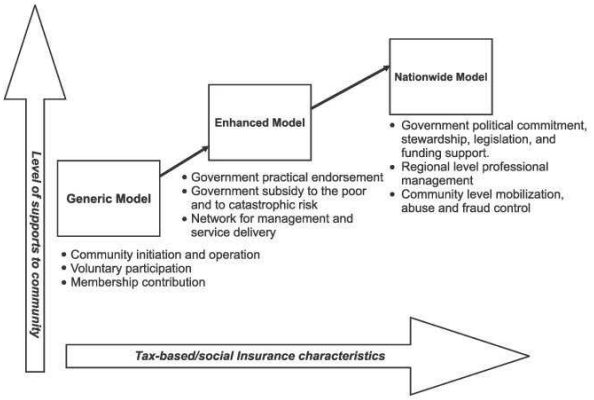

Figure 2: "CBHI Development Framework"[7]

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The payment method in the CBHI scheme affects the behaviour of both the provider and the patient. It has a role in healthcare worker satisfaction and participation. The healthcare workers if satisfied can support the scheme. It also affects the enrolment of participants in the scheme by access to quality health services.[3]

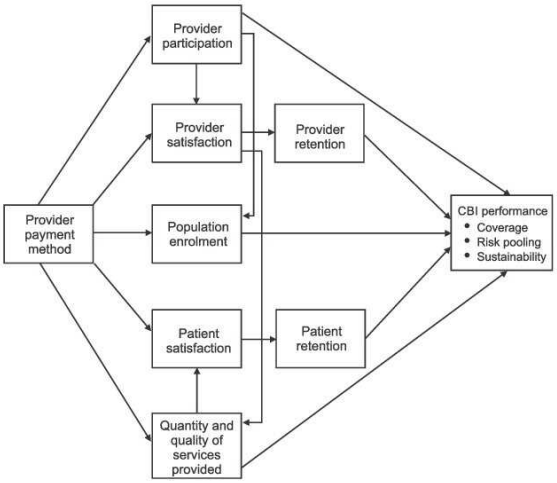

Figure 3: "Community-Based Health Insurance (CBI) Provider Payment Methods and CBI Outcomes"[3]

UNIVERSAL HEALTH COVERAGE & CBHI

Universal health coverage (UHC) ensures that all individuals have access to adequate health services of good quality i.e. health promotion, prevention, rehabilitation, treatment and palliation. It also warrants that these services do not expose the individuals to the economic burden. Globally, UHC has become a foremost objective for health reforms and a prime concern of the World Health Organization (WHO). In many developing countries, UHC has been difficult to achieve due to reliance on direct out of pocket costs including the consultation fees and over the counter payments for medicines. The WHO reports medical fees as a major obstacle in attaining health care utilization and encourages that risk pooling prepayment approach is the only mean for governments to achieve universal health coverage. In this aspect, CBHI has emerged as an effective approach in achieving UHC. There are 3 dimensions for measuring UHC. The first one is the percentage of the population which has access to health care and is represented by the width of the cube. The second is the financial cost provided by UHC as shown by the height of the cube and the third is the depth of the cube which demonstrates the health services provided by UHC.[7] These dimensions of UHC are depicted in figure 4.

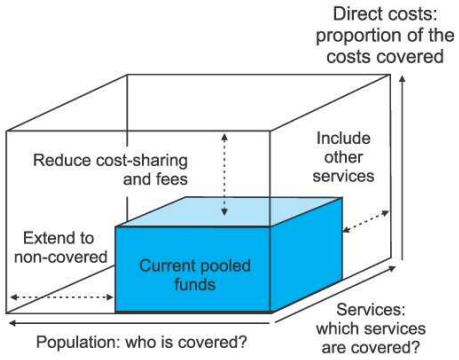

Figure 4: "Three Dimensions of Universal Health Coverage"[7]

The CBHI schemes are designed so that adequate financial resources are available for the low-income population with the provision of quality healthcare services.[5] There are 3 important characteristics of a CBHI scheme: community control, voluntary membership and prepayment of health services by its members.[9] For CBHI schemes to become sustainable and effective social protection mechanisms, there is a need to promote these schemes on a large scale.[10]

BARRIERS TO HEALTHCARE FACILITIES IN RESOURCE-POOR SETTINGS

The major impediment to access health care particularly in a resource-poor setting is the inability to pay out of pocket expenditure. Each year, these financial barriers prevent millions of people to acquire basic health services.[11] Globally none of the countries is fully able to provide health insurance to people due to the insufficient health budget. Among the highly developed countries, reports have shown that 46 million Americans have inadequate health services coverage.[12] According to the WHO, 150 million people experience financial catastrophe each year across the globe and 100 million are pushed below the poverty line due to expenditure on health care. The poor financial risk protection greatly affects the low and middle-income countries.[7]

STUDIES ON THE IMPACT OF COMMUNITY BASED HEALTH INSURANCE

A systematic review conducted in low and lower-middle-income countries of Asia and Africa reported that CBHI provides financial protection and improves service utilization & resource mobilization. However, the influence of CBHI on community empowerment is inconclusive. This study also showed that CBHI has a weak effect on the quality of health care provided.[13]

Mwaura et al. in 2012 conducted a study among the urban poor in Kenya by collecting data from the 420

respondents. According to this study, CBHI provided better health care to low-income people. Among the insured respondents, the health insurance program covered 86% of admissions. Similarly, the hospital admissions were greater in the insured group.[11]

Another systematic review reported an effective role of CBHI in the provision of financial protection in low-income countries. However, it has no impact on the efficiency with which care is provided or the quality of care but there is moderate evidence that these schemes improve cost recovery.[14]

In a systematic review, 14 studies were included from Asia and 9 from Africa. The results showed that the health insurance program contributed to the financial protection of low-income households most of the time by reducing household borrowings, health expenditure and poverty. It also had a constructive role in savings and household assets.[2]

A cross-sectional study was done in Laos in which insured and uninsured participants, 126 in each group, were enrolled. It revealed that CBHI does not improve access to health services and financial protection. However, in contrast to the uninsured group, the insured participants have better access to health services with lower chances of reaching the threshold of financial catastrophe.[15]

Hounton et al. conducted a study from April to December 2007 in rural Burkina Faso, Africa. According to this study, there are 2 times more chances for the insured members to utilize health care services as compared to the uninsured members. However, the overall mortality was the same in insured and uninsured members. The education level and the distance from the health care facility affected the risk of mortality.[8] A similar study was carried out in rural Burkino Faso. The CBHI scheme was randomly offered to 33 clusters of the study population. A total of 890 participants took part in the study from 41 villages and one town. The study showed that CBHI plays a vital role in protecting household assets.[16]

LIMITATIONS OF CBHI IN LOW-INCOME COUNTRIES

- The CBHI schemes have a poor technical & regulatory framework and weak legislation which affects its implementation and enrolment in the CBHI scheme.[13]
- The major hindrance for CBHI schemes in sub-Saharan Africa including Nigeria is the limited resource mobilization and a lower rate of enrolment of participants.[5]
- The CBHI schemes in several African countries have poor sustainability as the poor people cannot pay sufficient premiums for these schemes.[17]
- De Allegri et al. review in sub-Saharan Africa highlight that CBHI in this region has operational difficulties due to which it does not provide financial protection and better access to health care.[18]
- In Rwanda and Uganda, studies have reported high operational costs and lower rates of renewal of CBHI schemes.[13]
- Another study in Burundi reported the discrimination of healthcare workers against cardholders as they provided better treatment to patients paying in cash.[13]
- A systematic review by Spaan et al. found a weak effect of CBHI on the quality of health care provided in low-income countries.[13]

POLICY INTERVENTIONS TO STRENGTHEN CBHI

Some studies have emphasized that policy interventions should be undertaken to strengthen CBHI and improve its impact in health systems. These interventions are the establishment of proper legislation for CBHI schemes, endorsement of risk management measures, measures to increase the enrolment of people and significant investment from sponsoring agencies and host countries.[18] According to Umeh & Feeley, the CBHI scheme should be flexible with a subsidized premium and payment in installments by the poor. The CBHI scheme should also provide coverage in the time between premium payments.[19]

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Original Article

Text Neck Syndrome among Students of a Medical and Dental College in Lahore

Farooq Azam Khan, Asfand Waqar, Suhail Niaz Khan Niazi

ABSTRACT

Objective: To determine the frequency of text neck syndrome among medical and dental students of Sharif Medical and Dental College, Lahore.

Methodology: It was a cross-sectional survey conducted in Sharif Medical and Dental College, Lahore. The study was approved by the institutional ethical committee and informed consent was taken from all the participants. A total number of 120 MBBS and BDS students were enrolled in the study by a nonprobability consecutive sampling technique. One hundred students of MBBS, 20 from each class and 20 students of BDS, 5 from each class participated in the study. The participants were asked to complete a structured questionnaire including demographic information (name, age, gender) and duration of mobile phone use, the Nomophobia Questionnaire (NMP-Q) and the Neck Disability Index (NDI).

Results: Among the 120 participants, mild nomophobia was found in 19(16%), moderate nomophobia in 80(67%) and severe nomophobia in 21(17%) of the students. Fifty students (42%) reported neck pain during prolonged mobile phone use. The NMP-Q has a positive correlation with the NDI, having Pearson's correlation coefficient (r) of 0.41, $p < 0.001$.

Conclusion: The prolonged use of mobile phones is associated with a greater frequency of neck pain and a higher NDI score. There is a significant positive correlation between text neck syndrome and mobile phone usage. Initially, the musculoskeletal changes are short term but can cause disabilities in later life if proper care and prevention are not taken.

Keywords: *Text neck syndrome. Mobile phone. Musculoskeletal pain.*

INTRODUCTION

Text neck syndrome is a type of stress injury that occurs due to repeated frequently forward and downward flexion of the head towards a mobile phone, tablet or other devices for a prolonged duration. It is also known as an overuse syndrome that causes neck pain and soreness. This condition results in muscular fatigue. It is the most common cause of musculoskeletal neck pain in adolescent age group.[1]

The latest technology has a great impact on the lifestyle of humans.[2] Mobile phone is the most commonly used device for communication and entertainment nowadays. The newer versions of this device are used to do the necessary tasks. From retrieving an e-mail to access bank accounts, all has become possible with this handheld device. Access to the latest news and information is at the fingertips. Students have now the ease of obtaining the relevant information and social media tasking. The screen time for an average mobile user has increased significantly.[3,4] The excessive use of mobile phones has grave short and long term consequences. The short term consequences are the inability to concentrate and anxiety. The long term consequences are personality disorder, mobile phone addiction and text neck syndrome.[2] According to a recent estimate at least 77% of the global population owns a mobile phone. According to a study conducted in Jordan, mobile phone usage by the medical students is almost 5.9 hours per day.[3,4]

The cervical spine is composed of bones, joints, muscles and nerves regulated by the spinal cord and brain. The nerves of brachial plexus can be irritated by excessive neck flexion, resulting in pain of the shoulder, arm and hand. Prolong or continuous looking forward and down at cell phones can cause upper back pain and muscle spasm (Figure 1). Text neck syndrome can result in pain of neck, shoulder and back, chronic headache and increased bending of the spine.[5] If patients of text neck syndrome are left untreated, then it can trigger an inflammatory reaction of the neck musculature, ligaments and nerves.

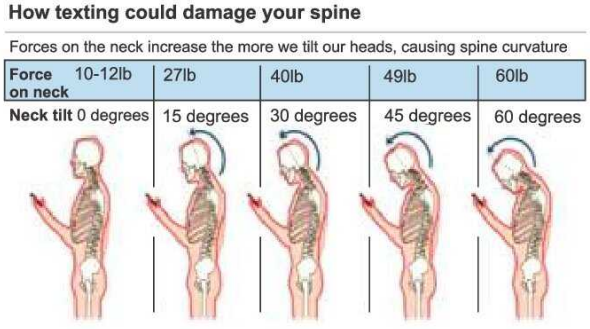

Figure 1: Text Neck Syndrome among Mobile Phone Users[1]

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It can also lead to grave complications like changes of the spinal curve, early arthritic changes, spinal malalignment, herniation of disc and compressive neuropathy.[6] Text neck syndrome has emerged as a significant health problem and has the potential to affect people of all ages globally.[5] It is essential to document the association between mobile phone use and text neck syndrome in our population. Therefore, this study was planned to determine the frequency of text neck syndrome in medical and dental college students using mobile phones for prolonged duration to establish a correlation. The aim was to increase awareness particularly among medical students regarding text neck syndrome so that they avoid unnecessary use of mobile phones and try to decrease their screen time. Individuals with text neck syndrome should be encouraged to do physiotherapy and cervical musculature strengthening exercises.

METHODOLOGY

It was a cross-sectional survey conducted in Sharif Medical and Dental College, Lahore. The study was approved by the institutional ethical committee and informed consent was taken from all the participants. A total number of 120 MBBS and BDS students were included in the study by nonprobability consecutive sampling technique. One hundred students of MBBS, 20 from each class and 20 students of BDS, 5 from each class participated in the study. Students who were willing to participate in this study and used a mobile phone for more than 2 hours per day were eligible for inclusion. Students with a history of cervical spine trauma or any neurological symptoms were excluded from the study. The participants were asked to complete a structured questionnaire including demographic information (name, gender, age) & duration of mobile phone use, the Nomophobia Questionnaire (NMP-Q) and the Neck Disability Index (NDI).

Nomophobia Questionnaire

Nomophobia stands for No Mobile Phone Phobia. It is a psychological condition in which individuals become apprehensive/ have a fear without access to their mobile phones. The NMP-Q is used to measure nomophobia.[7] It comprises 20 questions that address 4 factors of nomophobia: (a) inability to communicate (b) lack of connectedness (c) information access issues and (d) inconvenience. The score of each item ranges from 1 (strongly disagree) to 7 (strongly agree) using a 7-point Likert scale with the maximum score of 140. The interpretation of scores is as follows: score 20 indicates the absence of nomophobia, 21-59 mild nomophobia, 60-99 moderate nomophobia and 100-140 severe nomophobia. Yildirim and Correia established the validity of NMP-Q in 2015.[8]

Neck Disability Index

It is calculated by using a questionnaire with 10-items. The highest score for each item is 5, with a total score of 50. The questions are designed to assess the intensity of neck pain, associated headache and the impact of neck pain on various daily activities (personal care, work, reading, concentration, sleeping, recreation, driving and lifting weight). A high score is indicative of severe neck disability. The score of 0-4 shows no disability, 5-14 shows mild, 15-24 moderate, 25-34 severe and above 34 complete disability. It is also a validated score and was first time introduced by Vernon and Mior in 1991.[9]

STATISTICAL ANALYSIS

Statistical Package for the Social Sciences (SPSS) version 25 was used for data analysis. The qualitative variables such as gender, nomophobia grades and pain were expressed as frequencies and percentages. The quantitative variables such as age, NMP-Q and NDI were expressed as mean and standard deviation. The association between NMP-Q and NDI scores was determined by using the Pearson's correlation coefficient (r).

RESULTS

A total number of 120 participants were included in this study from Sharif Medical and Dental College, Lahore. Among the 120 participants, 54(45%) were males and 66(55%) were females. The mean age of the participants was 20.5±2.5 years. The average duration of mobile phone usage was 5 hours per day. Among the participants, mild nomophobia was found in 19(16%), moderate nomophobia in 80(67%) and severe nomophobia in 21(17%) of the students. Figure 2 shows the NMP-Q results of the students.

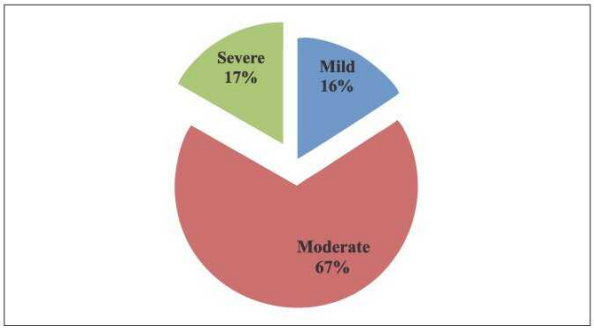

Figure 2: Showing the Results of Nomophobia Questionnaire (NMP-Q) of the Students

Fifty students (42%) reported neck pain and 42(35%) had mild neck disability index scores due to prolonged mobile phones use. Out of 50 students, 38(76%) students used mobile phone for more than 6 hours/day. Two (4%) students had mild nomophobia, 12(24%) students had moderate nomophobia and 36(72%) students had severe nomophobia. The graphical depiction of neck disability in medical & dental college students is shown in figure 3.

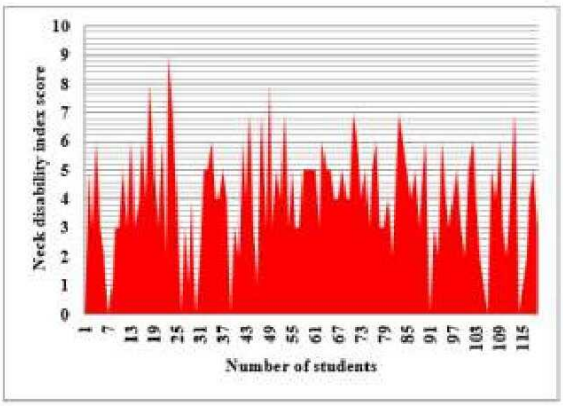

Figure 3: Graphical Depiction of Neck Disability in Medical & Dental College Students

The mean values of the NMP-Q and NDI scores are 81.40(75.13-87.67) and 6.2(2.5-9.8), respectively. There was a positive correlation between NMP-Q and NDI, having Pearson's correlation coefficient (r) of 0.41, $p < 0.001$ (Figure 4).

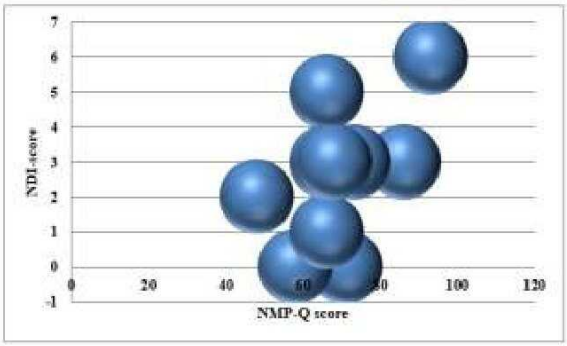

Figure 4: Correlation of Higher NMP-Q Score with NDI of the Study Participants

DISCUSSION

Cell phone is used by almost 79% population daily and its usage is increasing day by day. It results in poor slouched posture. The head is flexed forward in heavy mobile phone users and it causes loss of cervical lordotic curve. This leads to increased stress on the cervical spine and stiffness of neck and shoulder musculature. Neck pain has become a very common complaint.[6,10] It is of utmost importance to raise awareness of text neck syndrome among mobile phone users.

Our study showed that 42% of the students had neck pain and 35% had mild neck disability index scores due to prolonged mobile phone use. Comparable results were found in another study by Ahmad et al. in which 46.9% of students of physiotherapy had neck pain and 42.5% reported neck disability.[4] Even higher frequency of neck pain was observed in other studies. A study conducted in 2015 by Kim et al. among university students of Korea showed that 55.8% of students had neck pain with the constant use of mobile phones.[11] A systematic review was done to assess the frequency of musculoskeletal complaints with the use of mobile phones. The results showed that musculoskeletal complaints range from 1% to 67.8% and neck pain ranges from 17.3% to 67.8% among mobile users.[12] A study carried out in undergraduate students of Punjab University and the University of Lahore, Lahore showed that there was higher neck pain prevalence among undergraduate students. There were a total of 402 participants in this study and 228(56.7%) students had neck pain.[13]

A study conducted by AlZarea et al. found that 55% of the patients presented with neck pain and headache with the use of mobile phones.[14] The use of mobile phone results in the forward inclination of the head and neck towards the screen, which causes postural changes and can lead to long term neck pain.[1] A study conducted in Thailand showed alarming results related to text neck syndrome and termed it as an epidemic. According to the researchers, the mobile phone is the most popular device and surpasses the laptops and computers. This study also showed that approximately 62.3% of mobile phone users experienced neck pain.[15]

In our study, we observed a significant positive correlation ($p < 0.001$) between the NMP-Q and NDI. Comparable results were shown in a study by Shah et al. The study enrolled 100 physiotherapy students from Ahmadabad, India and established a significant correlation between the use of mobile phone and neck disability index.[16] Another study reported a positive correlation between NMP-Q and NDI (r 0.36, $p<0.001$).[3]

Simple lifestyle modifications like postural changes during the use of mobile phones and avoiding prolonged use can prevent neck pain. This study would be a source of awareness to help mobile phone users about the harmful effects of mobile phones. However, there are a few limitations. The sample size was not large. Moreover the study was carried out in a single

medical and dental college. Further studies with a larger sample size and a multi-centered setting can be done for more comprehensive results.

CONCLUSION

The prolonged use of mobile phones is associated with a greater frequency of neck pain and a higher NDI score. There is a significant positive correlation between text neck syndrome and mobile phone usage. Initially the musculoskeletal changes are short term but can cause disabilities in later life if proper care and prevention are not taken.

RECOMMENDATIONS

- The awareness of text neck syndrome should be raised among the students.
- They should be encouraged to decrease their screen time and take frequent small breaks after every 20 minutes during mobile phone use.
- The mobile phones should be held higher so that they align with the eyes reducing strain on neck muscles.
- Posture focused exercises should be done.

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Original Article

Race Against the Clock - A Study of Time Management Skills of Medical Teachers

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ABSTRACT

Objective: To study the time management skills of medical teachers working at two private medical colleges in Lahore.

Methodology: This was a cross-sectional study that used the nonprobability convenience technique for sampling. One hundred and twenty two (122) medical teachers from both Clinical and Basic Sciences Departments completed the time management skills test (TMST) voluntarily and anonymously.

Results: The mean score achieved by the medical teachers (55.44) was on the borderline between good (scores from 41 to 56) and poor scores (scores from 56 to 100) on TMST. Male medical teachers had significantly better time management skills as compared to female teachers. Teachers of Clinical Sciences Departments had significantly better time management skills as compared to teachers of Basic Sciences Departments.

Conclusion: There was no significant difference in the age group the participants belonged to and their overall total TMST score. There is considerable room for improvement in the time management skills of the medical teachers. By improving time management practices, medical teachers can free up valuable time for research and other academic as well as clinical commitments. Medical education department should include time management training as part of the faculty development programs.

Keywords: *Time management. Work performance. Medical education.*

INTRODUCTION

Medical teaching is a highly demanding job. Medical teachers have to comply not only with day to day academic responsibilities but also have to keep themselves updated and require continuous professional development. These are in addition to personal, family and social responsibilities. The already busy schedule becomes more demanding and hectic if this teacher is a clinician too, especially involved in private practice. In such situations, the most important skill one needs to acquire is "Time Management Skill" (TMS). The importance of this skill can never be over-emphasized as it can not only affect the professional performance of a medical teacher but also may adversely affect the personal & social life as well as the health of the teacher. Lack of time is the topmost reported reason for not publishing research presented as abstracts at biomedical conferences.[1] Experts have argued that universities should start teaching time management skills to first-year students as many of them find it difficult to effectively use their time for self-study.[2]

Time management strategies include prioritizing tasks, making to-do lists, setting clear goals, effective networking and building work relationships.[3] Studies have shown that time management is positively and significantly related to character traits such as diligence, discipline and responsibility.[4] A significantly positive relationship has been reported between time management and executive power.[5] Good time management skills also appear to have a positive and significant relationship with effective delegation skills.[6]

A study of nursing students in three medical universities from Tehran reported that there was a significant negative relationship between time management skills and state anxiety. They also reported that there was a positive significant relationship between time management skills and academic motivation.[7] Kilbert and colleagues found a significant correlation between procrastination and suicide indices.[8] In another study, procrastination was found to be associated with lower life satisfaction levels and higher stress, depression and anxiety scores.[9]

Doctors early on in their careers participate in more passive forms of recovery and are not completely able to detach themselves from work during their free time.[10] This has obvious repercussions on their sense of wellbeing and overall productivity. A study of Turkish undergraduate nursing students reported a positive and significant relationship between the time management skills of the students and their readiness for self-directed learning.[11] A survey of preclinical safety workers found that nearly a third of the respondents

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(34.3%) found the prioritization of tasks as the greatest challenge in terms of time management. This was followed by focusing on individual tasks (26%), the delegation of tasks (12.4%), procrastination (12.4%) and the organization of workspace (6.2%).[12] A study from Iran found that emergency medical technicians who have effective time management skills tend to undergo less work-family conflict as compared to their colleagues with less effective time management skills.[13] Teachers often feel that paperwork, communication with parents or guardians and disciplining students take a considerable chunk of teacher's time. Barjesteh and colleagues assessed 202 english language teachers on measures of creativity and time management. They found that teachers with more effective time management skills like daily planning, confidence in long-term planning and perceived control of time tended to be more creative in the classroom.[14] Better time management skills can lead to increased study engagement in students.[15] Boredom in students can be reduced when students use time management techniques for managing leisure time and properly plan and organize their leisure time.[16]

The purpose of the current study was to assess how effective medical teachers are in managing their time. This is an important question as better time management on part of the medical teachers will hopefully lead to better professional and personal outcomes of the medical teachers themselves and for the overall medical education system in general.

METHODOLOGY

This was a cross-sectional survey-based descriptive study. The sampling was done through nonprobability sampling technique. The sample size was calculated using the GPower software version 3.1.9.4 using the following specifications: a two-tailed test, an effect size d of 0.5, α error of 0.05 and a power (1-β) of 0.80. Thus a sample size of 128 was calculated.

One hundred fifty two questionnaires were distributed among medical teachers of two medical colleges and 127 completed forms were received back. Ethical approval for the study was granted by the institutional review board at Azra Naheed Medical College, Lahore. Faculty of both the Basic and Clinical Sciences Departments at two private medical colleges (Azra Naheed Medical College and Sharif Medical & Dental College) in Lahore were invited to complete the TMST questionnaire through face to face contact. Informed consent was received from all the study participants and the confidentiality of the data was ensured.

We used the time management skills test (TMST) offered by the Oregon Department of Human Services (ODHS).[17] It is a 25 items questionnaire that offers 4 options to each item i.e. 1=always, 2=usually, 3=sometimes and 4=never. The possible range of scores is from 25 to 100. Scores from 25 to 40 denote excellent time management skills, scores between 41 and 56 represent good time management skills while individuals scoring between 56 and 100 are deemed to have poor time management skills. A total of 127 medical teachers completed the TMST. Out of these, 5 questionnaires were only filled in part and therefore were not included in the final analysis. Thus, a total of 122 responses were analyzed.

STATISTICAL ANALYSIS

The results were entered and analyzed in Statistical Package for the Social Sciences (SPSS) version 23. Descriptive methods were used to describe the results. Frequencies were reported for medical teachers having good, average and poor time management skills on TMST. Mean, standard deviation and confidence intervals were used to describe the overall results. Independent samples t-test was employed to calculate the difference on TMST between medical teachers on the basis of gender and whether they belonged to Department of Clinical or Basic Sciences.

RESULTS

The number of male teachers was 66(54.1%), while 56 teachers were females (45.9%). The number of teachers belonging to Basic Sciences Departments was 79 (65.6%), while 42 teachers belonged to Clinical Sciences Departments (34.4%). Sixty six (66) of the medical teachers had MBBS as their highest qualification (54.1%), while 44 participants (36.1%) had a higher clinical qualification (FCPS/MRCP/MRCS/FRCS/US Board). For twelve (9.8%) participants the highest qualification was M. Phil/PhD. Forty four (36.0%) medical teachers had less than 5 years of experience as a teacher, 45(36.9%) had an experience of 5-10 years, 30(24.6%) teachers had an experience of 11-20 years and 3(2.5%) teachers had experience of more than 20 years. Concerning the age, 48 teachers (39.3%) were in their 20's, 26 teachers (21.3%) were in their 30's, 34 teachers (27.0%) in their 40's and 15 teachers (12.3%) were older than 50 years. Out of the total 122 teachers participating in the study, 12 teachers (9.8%) had excellent time management skills, 58(47.5%) had good time management skills and 52(42.6%) had poor time management skills (Figure 1). The mean score of our study participants on TMST was 55.44±13.03 (95% confidence interval: 53.10-57.77). This mean score is at the boundary between good and poor grades on TMST which suggests that there is

ample room for improvement in the time management skills of the medical teachers participating in our study (Figure 2). Independent samples t-test was used to analyze the difference between the genders on their total score. Male medical teachers were significantly better in managing their time as compared to female medical teachers (p= 0.02). Faculty of the Clinical Sciences Departments were significantly better at managing time than faculty of the Basic Sciences departments (p=0.019). There was no significant difference between age group of the participants and their overall total TMST score. Table 1 shows the detailed distribution of the scores achieved by medical teachers in terms of gender and affiliation with Clinical or Basic Sciences.

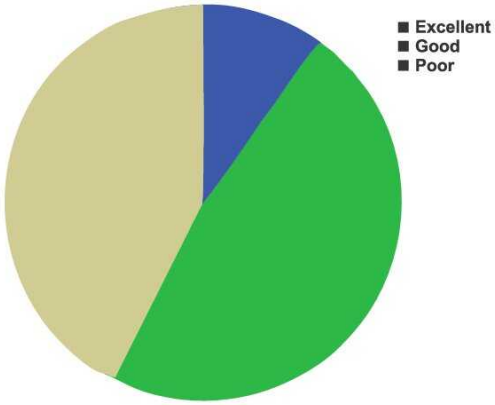

Figure 1: Pie Chart of the Scores Achieved by Medical Teachers on Time Management Skills Test

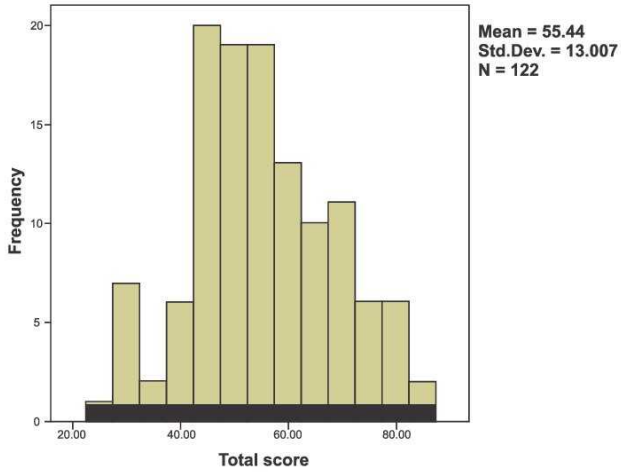

Figure 2: Histogram of the Total Scores on the Time Management Skills Test (TMST) with the Mean and SD

Table 1: Scores on TMST in Associations with Gender and Affiliation of the Participants with Basic or Clinical Sciences Departments

TMST Score	Clinical Sciences Department		Basic Sciences Department		Total
	Male	Female	Male	Female	
Excellent Score on TMST	8	1	2	1	12
Good Score on TMST	17	4	14	23	58
Poor Score on TMST	4	8	22	18	52

Table 2: Comparison of Gender & Departmental Affiliation of Faculty with Time Management Skills Test

Comparison on the Basis of Gender					
Gender	N	Mean	Standard Deviation	Standard Error of Mean	p-value
Male	66	53.0000	12.76172	1.57086	0.021
Female	54	58.5370	13.06546	1.77798	
Comparison on the Basis of Departmental Affiliation					
Faculty	N	Mean	Standard Deviation	Standard Error of Mean	p-value
Clinical Sciences Departments	42	51.6429	14.97286	2.31036	0.019
Basic Sciences Departments	79	57.4937	11.56351	1.30100	

DISCUSSION

There is already a considerable burden on the medical teachers regarding time availability as they have to juggle many roles at a time as a requirement of their job e.g. their role as a teacher, clinician, role model, mentor and researcher. It is essential to equip medical teachers with time management skills that would lead them to manage these roles more effectively. It has been previously reported that effective time management skills are important to increase productivity for researchers.[18]

There is a shortage of studies examining the time management skills of medical teachers and the effect of poor time management on outcomes such as research productivity, patient waiting times and student grades, etc. in Pakistan and South East Asia. To our knowledge, this is the first study to document the time management skills of medical teachers in Pakistan. The mean score achieved by the medical teachers participating in this study is on the borderline between the good and poor scores on TMST, which shows that even a modest increase in time management skills is likely to help medical teachers utilize their time more effectively. A study of 180 senior nurse managers in Iran reported that the majority experienced a favorable time management profile.[19] A Turkish study of nursing and midwifery students noted that students had mid-level time management skills. There was a negative correlation between the level of anxiety and the students' ability to manage time.[20] Another investigation of undergraduate nursing students also reported a moderate level of time management skills (49%) amongst the students.[7] A qualitative study from Saudi Arabia conducted among family medicine undergraduates concluded that to achieve positive outcomes it was necessary to focus on the sub-domains of time planning, organizing, directing and controlling.[21] A survey of 200 principals and 600 teachers of secondary schools in Nigeria identified that the main impediments to time management were the need to respond to emergency cases at school, urgent calls from higher authorities, crisis resolution, personal activities outside the school and unscheduled visits of officials among other causes.[22] Grissom and colleagues explored the relationship between time management and job stress in 300 principals of public schools in the United States and found that principals with good time management skills had significantly reduced job stress levels.[23] A study of medical students from Turkey reported a positive and significant relationship between their time management skills and academic achievement.[24]

In our study, male medical teachers had significantly better time management skills as compared to female medical teachers. This is an interesting and counterintuitive finding as one would expect females who juggle many responsibilities including childcare and household responsibilities with work to exhibit better time management techniques. However, results from previous studies in regards to gender and time management skills have been mixed. An Iranian study found that female nurse managers were better in managing their time as compared to their male colleagues.[19] Researchers from Turkey reported that female students were significantly better in terms of their ability to manage time than male students.[20] Another study of medical students from Turkey also reported that female medical students achieved higher scores on time management skills questionnaires as compared to male students.[24] An investigation of time management and communication skills of physical education and sports students concluded that although males had a better understanding of time management, females had better mental and behavioral communication skills.[25] The role of gender and how it affects medical education is certainly one of the key areas that needs further research as no firm conclusions could be drawn about the relationship between time management and gender-based on currently available information in the literature.

Medical faculty of the Clinical Sciences Departments had significantly better time management skills as compared to the faculty of the Basic Sciences Department in our study. It is difficult to say whether this is a consistent effect and will be replicated in other studies. One possibility in this regard is that the faculty of Clinical Sciences Departments has over the years been able to develop some techniques to manage their time in a more effective way to deal with the additional demands of their clinical commitments and private practice. To the best of our knowledge, no previous study has compared the time management skills of medical teachers of Basic and Clinical Departments.

Several measures can be adapted to help to reduce the pressure medical teachers have on time availability. A careful restructuring of how physicians handle patient records can free up to 56 hours per year of their time.[26] A US study concluded that streamlining billing practices can save up to 4 hours of physician's time per week.[27] In the UK, wards have been redesigned so that nurses and other ward staff can make the best use of their time.[28]

Many of the items asked on the TMST do not require much investment of time or resources for effective changes to be made. So, the improvement in these behaviors can improve the situation significantly. For example writing down specific objectives of work towards goals, using a calendar to write down

appointments, deadlines and things to do, making daily to-do lists, organizing desk and work area and assigning priorities to tasks, etc may help. It just requires a mental change on behalf of the person and a will to change to make things right on these and many other items on the TMST. Therefore, a short, 2 to 3 days training in time management is likely to be effective in helping the faculty change their attitude towards time and its management. A qualitative study of nurses in emergency care department identified time management skills as one of the key management skills needed for professionals at emergency care units.[29]

Future research needs to focus on the interaction and association between effective time management practices and mental health outcomes e.g. reduction in stress and anxiety levels, especially in the local Pakistani context. Similarly, the effect of good time management practices on actual job performance and job stress levels needs to be investigated further in the local context. This is an important area of research as time management training of medical teachers as well as medical students can be achieved with relatively modest financial and administrative resources. However, further research is needed to see whether this is a consistent finding replicated in other parts of the country and continent as well. Further studies are also needed to study the effects of improving time management skills on various academic, research and clinical outcome measures.

CONCLUSION

There is considerable room for improvement in the time management skills of the medical teachers. Time management skills of medical teachers have been at less than the desired level in this study.

RECOMMENDATIONS

Medical education departments should incorporate time management training as part of the faculty development programs. This will reduce job stress and other health-related outcomes for medical teachers and will result in better education-related and clinical outcomes as well.

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Original Article

Effects of Corticosteroid versus Placebo in Controlling Post-Procedural Sequelae after Impacted Third Molar Surgery: A Randomized-Controlled Trial

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ABSTRACT

Objective: To compare the outcome of dexamethasone versus methylprednisolone in controlling post-procedural pain and better mouth opening after impacted 3rd molar surgery.

Methodology: This single-blinded randomized controlled trial was done at the Department of Oral & Maxillofacial Surgery, Sharif Medical & Dental College, Lahore over a period of 6 months. Forty five patients requiring 3rd molar removal were enrolled in the study through a probability consecutive sampling technique. Patients were divided randomly into three groups. Group A was given dexamethasone, group B was given methylprednisolone and in group C placebo was given. Surgical removal of 3rd molar was carried out, pain and mouth opening was assessed preoperatively and postoperatively on day 1 and 7 after surgery.

Results: The difference in pain score was insignificant ($p > 0.05$) at baseline but significant after 1st & 7th postoperative day among all groups. Pain was significantly low in group A & B than group C ($p < 0.05$). However, group A & B had an insignificant difference in pain. In all three groups, mouth opening was decreased significantly at day 1 after surgery but later on increased significantly on day 7th. The difference in mouth opening was insignificant ($p > 0.05$) at baseline but significant after 1st and 7th postoperative day ($p < 0.05$). Mouth opening was more in group A & B as compared to group C.

Conclusion: Corticosteroids can reduce pain and significantly improve the mouth opening if given before 3rd molar extraction.

Keywords: *Dexamethasone. Methylprednisolone. Post-procedural pain. Mouth opening. Impacted third molar surgery.*

INTRODUCTION

The 3rd molar erupts generally between 18-24 years of age, but eruption time has wide disparities. Eruption failure of the 3rd molar is a very common problem, which requires surgical removal. Extraction of unerupted 3rd molar is the commonest surgical procedure in dentistry all over the world.[1] After extraction of 3rd molar, pain is the most common complication followed by dry socket.[2] It can also cause postoperative swelling and other disorders, which might be temporary or everlasting, including trismus as well as paresthesia. Pain is considered to be the most severe complication and can occur in 93% cases within the first 24-48 hours of the procedure. So, preoperative administration of analgesics (preemptive analgesia) can be helpful in minimizing the postoperative pain, swelling as well as trismus.[3,4]

Preemptive or intraoperative analgesia includes therapies which averts the development of essential sensitization because of peripheral nociceptor activity after surgery.[5] The commonly used analgesics before or during the extraction of 3rd molar are non-steroidal anti-inflammatory drugs like ibuprofen and diclofenac and centrally acting analgesics including tramadol.[6-8]

The two most common corticosteroids applied for preemptive analgesia are methylprednisolone and dexamethasone,[5] Corticosteroids are categorized based on the duration of their action. Examples of short-acting corticosteroids are hydrocortisone and cortisone. The duration of action of short acting corticosteroids is <12 hours and has anti-inflammatory potency of 1. Midway acting corticosteroids act for 12-36 hours. Examples are prednisone, methyl-prednisolone and triamcinolone. Prednisolone has anti-inflammatory potency of 4, while methylprednisolone and triamcinolone have anti-inflammatory potency of 5. Dexamethasone as well as betamethasone are long-acting corticosteroids, having duration of action >36 hours and anti-inflammatory potency of 25.[9]

According to literature, corticosteroids significantly reduce postoperative swelling as well as trismus but their effects regarding postoperative pain are still conflicting.[10] However, there is no such agreement in literature regarding the most effective corticosteroid when applied preemptively to reduce the pain after surgical extraction of 3rd molar.[5,11]

So, we conducted this trial to compare the outcomes of preoperative administration of methylprednisolone versus dexamethasone in achieving better post-procedural outcomes after impacted 3rd molar surgery. This study would confirm which drug is more effective

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in reducing postoperative pain and achieving maximum mouth opening after 3rd molar extraction in our setting.

METHODOLOGY

After taking permission from the ethical board, this single-blinded randomized controlled trial was conducted in the Department of Oral & Maxillofacial Surgery, Sharif Medical and Dental College, Lahore. A total sample size of 45 cases; (15 allotted to each group) was estimated by applying 95% confidence level, 80% power of the study and taking the magnitude of mean mouth opening i.e. 30.23±3.884 mm with dexamethasone and 25.73±3.667 mm in control group after 3rd molar extraction. The patients were enrolled by probability sampling technique and then divided randomly into three equal groups by computer generated random tables. Patients having diabetes, hypertension, allergy to trial drugs, pregnant or lactating females, asthma, cardiac disease were excluded from the study. Informed consent was taken and demographics were noted. Candidates were examined for intensity of pain by using a visual analogue scale. Visual analogue scale (VAS) quantifies the intensity of pain. On a 100 mm VAS scale, 0-4 shows the absence of pain, 5-44 mm shows mild pain, 45-74 mm shows moderate pain and 75 to 100 mm shows severe pain. They were also evaluated for mouth opening by using a measuring scale preoperatively and findings were recorded in millimeters. Group A & B were intervention groups whereas group C was the placebo group. In group A, 4 mg (1 ml) dexamethasone was injected in submucosa 30 minutes before undergoing surgery. In group B, 40 mg (1 ml) methylprednisolone was injected in submucosa 30 minutes before undergoing surgery. In group C, normal saline injection was given to the patients. All the patients underwent 3rd molar extraction under local anesthesia by one surgical team. After the procedure, all the patients were given standardized postoperative instructions and medications and were recalled after 24 hours to record pain and mouth opening. Then the patients were followed-up on the 7th day of surgery and were re-examined for pain intensity and mouth opening.

STATISTICAL ANALYSIS

All the data was collected in proforma and then transferred to Statistical Package for the Social Sciences (SPSS) 22. Analysis of variance (ANOVA) was applied to compare mean postoperative pain and mouth opening in three groups. The Tukey's test was applied for pair-wise comparison of the three groups. A p-value ≤ 0.05 was taken as significant.

RESULTS

The mean age of patients in group A was 29.07±7.74 years, in group B was 31.60±6.31 years and in group C was 33.47±8.59 years. There were 8 males and 7 females in group A and B each while 5 males and 10 females in group C (Table 1).

Regarding pain, the difference in pain score was insignificant ($p > 0.05$) at baseline but significant after 1st & 7th postoperative day among all groups. Pain was significantly low in group A & B than group C ($p < 0.05$). However, group A & B had an insignificant difference for pain. In all three groups, mouth opening was decreased significantly at day 1 after surgery but later on increased significantly on day 7. The difference in mouth opening was insignificant ($p > 0.05$) at baseline but significant at 1st and 7th post-operative day ($p < 0.05$). Mouth opening was more in group A & B as compared to group C (Table 2).

Figure 1 & 2 show the trend of change in pain score and mouth opening during follow-up.

Pair-wise comparison showed that there is no difference in pain score at baseline in all groups but significant difference postoperatively on day 1 & 7 in

Table 1: Demographic Variables of the Patients Included in the Study

Variables		Groups		
		Group A	Group B	Group C
Age (Years)		29.07±7.74	31.60 ±6.31	33.47±8.59
Gender	Male	8(53.3%)	8(53.3%)	5(33.3%)
	Female	7(46.7%)	7(46.7%)	10(66.7%)
Position of the Involved Molar	Right	6(40%)	9(60%)	7(46.7%)
	Left	9(60%)	6(40%)	8(53.3%)

group A & B than group C. There was a significant improvement in mouth opening in group A & B as compared to group C, while the difference between groups A & B was insignificant (Table 3).

DISCUSSION

Mandibular 3rd molar is the most commonly impacted tooth which requires surgical extraction in many instances. Surgical removal of impacted tooth usually includes incision, flap reflection, tooth sectioning and bone removal which results in considerable postoperative pain, swelling and trismus. Attempts to reduce these postoperative complications, therefore seems to be a logical goal. Many trials investigated the methods to reduce post-operative sequel by applying corticosteroids.[12]

Several trials have recommended the application of corticosteroids for maximum reduction of post-operative complications like swelling, pain and trismus after the surgical extraction of mandibular 3rd molars. But precise dose, appropriate route and timing of application of such corticosteroids vary in previously published trials.[13]

The use of corticosteroids as anti-inflammatory agents in dental practice began in the 1950's with the administration of hydrocortisone to prevent inflammation in oral surgery.[14] Submucosal injection of 4 mg dexamethasone is a very effective way to improve the quality of life after surgical extraction of embedded mandibular 3rd molars. It is a simple, harmless, painless, non-invasive and cost-effective option of prophylaxis for many moderate to severe surgical difficulty level cases.[15]

In our study, the difference in pain score was significantly better in corticosteroid groups at 1st and 7th postoperative day as compared to the control group. Pain was decreased in dexamethasone and methyl-prednisolone groups as compared to the control group.

Table 2: Comparison of Mean Values of Pain & Mouth Opening among Three Groups during Follow-up

Study Variables	Groups			p-value
	Group A	Group B	Group C	
Preoperative Pain	31.00±8.25	33.73±7.33	34.47±10.16	0.518
Postoperative Pain at Day 1	24.60±6.19	26.93±6.37	41.60±9.85	0.001*
Postoperative Pain at Day 7	18.13±4.52	21.20±5.44	38.07±7.99	0.001*
Preoperative Mouth Opening	42.60±4.95	45.27±4.71	41.67±4.50	0.108
Postoperative Mouth Opening at Day 1	39.03±5.09	40.54±5.16	34.34±4.17	0.003*
Postoperative Mouth Opening at Day 7	41.78±4.75	44.40±4.84	39.93±4.80	0.047*

***Significant p-value ≤ 0.05**

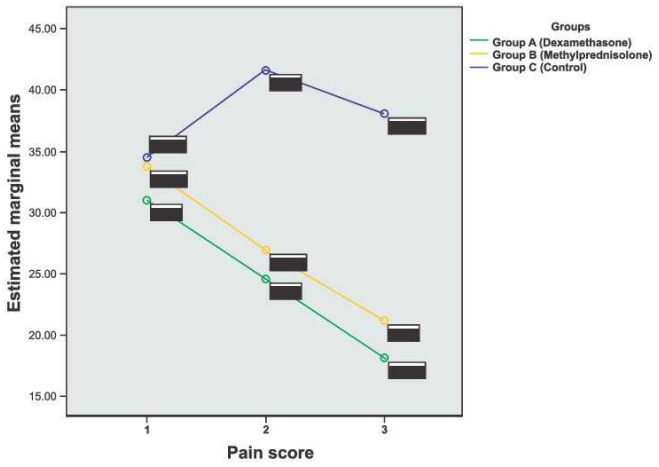

Figure 1: Showing Pattern of Change in Pain Score during Follow-up

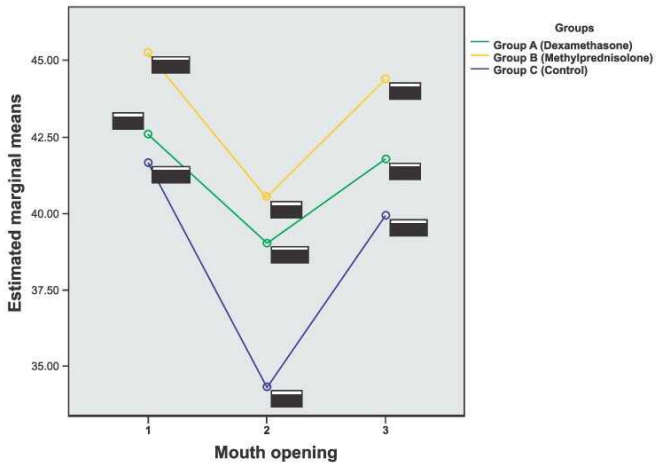

Figure 2: Showing Pattern of Change in Mouth Opening Score during Follow-up

Table 3: Showing p-values of Pair-Wise Comparison of Three Groups for Pain & Mouth Opening (Tukey's Test)

		Study Groups		
		Group A	Group B	Group C
Preoperative Pain	Dexamethasone	-	0.666	0.522
	Methylprednisolone	0.666	-	0.971
	Control	0.522	0.971	-
Postoperative Pain at Day 1	Dexamethasone	-	0.68	0.000*
	Methylprednisolone	0.684	-	0.000*
	Control	0.000*	0.000*	-
Postoperative Pain at Day 7	Dexamethasone	-	0.369	0.000*
	Methylprednisolone	0.369	-	0.000*
	Control	0.000*	0.000*	-
Preoperative Mouth Opening	Dexamethasone	-	0.281	0.852
	Methylprednisolone	0.284	-	0.105
	Control	0.852	0.281	-
Postoperative Mouth Opening at Day 1	Dexamethasone	-	0.672	0.029*
	Methylprednisolone	0.672	-	0.003*
	Control	0.029*	0.003*	-
Postoperative Mouth Opening at Day 7	Dexamethasone	-	0.303	0.547
	Methylprednisolone	0.303	-	0.038*
	Control	0.547	0.038*	-

***p≤0.05(Significant difference)**

The difference in mouth opening was insignificant in all groups at baseline and was significant at 1st and 7th postoperative day. There was a significant improvement in mouth opening in the dexamethasone group and methylprednisolone as compared to the control group, while the difference between the dexamethasone group and methyl-prednisolone was insignificant. Similar results were found in a systematic review of 28 studies. According to this review corticosteroids statistically decrease pain, trismus and swelling in patients after extraction of impacted 3rd molar.[16]

A randomized control trial conducted by Chugh et al., reported a significant reduction of pain and trismus in the dexamethasone group in comparison to the control group. Dexamethasone group patients also had less post-operative swelling and their quality of life was less affected when compared to the control group.[17] Our results are also comparable to this study as the steroid groups had lesser pain and significantly better mouth opening resulting in a better post-operative sequel.

A study was conducted by Lim et al. to compare the efficacy of dexamethasone with methylprednisolone in reducing postoperative sequelae in patients after surgical removal of impacted third molars. They reported that preoperative methylprednisolone versus dexamethasone were equally effective in decreasing the postoperative swelling as well as trismus. Regarding pain control, patients taking methyl-prednisolone preoperatively had significantly less pain as compared to the patients who received dexa-methasone.[18]

Our results showed that the preoperative administration of corticosteroids have a significant role in the postoperative reduction of pain and better mouth opening as compared to the control group. Comparable results were seen in other studies showing better control of postoperative sequelae by the use of corticosteroids before the procedure.[10,17]

According to a study by Alcantara et al., preoperative administration of dexamethasone had better control of swelling and limited mouth opening than methyl-prednisolone, while had insignificant differences for pain control.[19]

On the contrary, a study was conducted in Poland to investigate the effect of the preoperative and post-operative submucosal injection of 4 mg/ml dexa-methasone as compared to placebo after the extraction of retained lower third molars. In this study 90 patients were included and postoperative pain, the total number

of doses of analgesics consumed within 24 hours of the procedure, swelling and trismus were noted at 48 hours, 72 hours, and 7 days postoperatively. The results showed better pain control and less swelling and trismus were observed in patients who received dexamethasone in comparison to placebo. The study also found that the administration of dexamethasone postoperatively resulted in better pain control than the preoperative administration. [20]

The current study proves the role of corticosteroids in reducing pain and improving mouth opening of the patient but further trials are required to confirm these results with large sample size and follow-up for a longer period of time.

CONCLUSION

The corticosteroids can remarkably reduce pain and significantly improve the mouth opening if given before surgical extraction of 3rd molar. So, in future preoperative injection of corticosteroids can be implemented as a standard protocol for better outcomes of 3rd molar extraction.

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Original Article

Fatal Firearm Injuries: Pattern and its Association with a few Demographic Factors

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ABSTRACT

Objective: To determine the pattern of fatal firearm injuries and its association with a few demographic factors.

Methodology: This cross-sectional descriptive study was conducted on 324 subjects in Forensic Medicine Department, Khyber Medical College, Peshawar. A pre-designed autopsy proforma was used to extract all the relevant information including demographic data, while autopsy examination was done to identify two firearms patterns, namely the number of shots and velocity of bullet. Descriptive statistics were used for numerical and categorical variables while chi-square test was applied to look for association. A p-value of ≤ 0.05 was taken as significant.

Results: Out of total study subjects, 83% were males and the most common age of presentation was 21-30 years with 35.5% cases followed by 31-40 years with 19.1% cases while 0-10 years and more than 70 years were least common with only 1.2% cases. Among the cases 54.6% had multiple shots, 59% were shot by a high-velocity weapon and in locality distribution, 74.4% cases were rural based. Age group and gender had a significant association with the number of shots with a p-value of ≤ 0.05 while locality had no significant relationship with both firearm patterns. Both firearm patterns, number of shots and velocity of bullet were strongly associated with a p-value of <0.001.

Conclusion: The study concluded that middle-aged males were more prone to homicidal deaths. Homicidal deaths were more common in rural areas, using high-velocity weapons and having multiple shots. Age and gender were significantly associated with the number of shots. A significant relationship was recorded withing the pattern of firearms.

Keywords: *Homicide. Firearms. Weaponry patterns. High-velocity weapon. Number of shots.*

INTRODUCTION

Globally, deaths occurring due to firearms are increasing day by day. Many countries including developing ones have reported firearms being the most common technique or weapon of killing. The deaths reported due to firearms are increasing every year. The number varies from 50-90% depending upon the region.[1,2] European history reveals that overall deaths due to firearms are quite less. Among the reported homicidal deaths due to firearms, a shotgun is the most common weapon used for homicidal purposes. In contradiction, the sub-continent has a good bit of weapons like pistol, revolver, shotgun, rifle, etc., used for homicidal killings.[3,4] Many countries, particularly in Europe, laws based on illegal possession of weapons have been formulated making much fewer fatalities in those areas than in areas with no legislation like US, Pakistan, etc. These weapons are further used for homicidal purpose as compared to deaths with suicidal intention and the right to possess these weapons is a major issue.[5]

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Globally, when we analyze homicidal data, it seems to be a common endpoint of different behavioral pathways ranging from acquaintances augmentations, lack of tolerance, disputes in family, unemployment, state terrorism and many such social massacres.[6] While looking at homicidal deaths, it appears that majority of the cases are due to extreme social pressures, either as a mean to avenge, as an honor killing for the family's pride and unfortunately all these acts are lauded socially.[6] The lack of knowledge, the legal system, weak law enforcement departments, their casualness in crime detection and delaying tactics in justice dispensation are a few reasons that result in lack of confidence among masses for justice.[7]

A human body is composed of diverse body parts and organs, each of which reacts separately to incoming bullet or pellet etc. Thus an injury to the skull will be quite different from the other cavities such as the abdomen. Pattern of firearms varies, few relate with number of shots which cause the death, while others associate it with the weapon used by estimating the velocity of the bullet that caused an injury during examination.[8]

This study was planned to determine the pattern of firearms encountered in homicidal deaths in terms of bullet velocity & the number of shots and their association with a few demographic factors. The study enlightened the aspects of associations between the

demographic factors and firearm patterns, which may be used to draw out legislative measures to prevent or decrease homicidal firearm deaths. The knowledge can also prove fruitful for the treatment and management of such firearm victims.

METHODOLOGY

This cross-sectional descriptive study was conducted at the Forensic Medicine Department, Khyber Medical College, Peshawar. A complete history leading to external and internal examination was the strategy adopted. A total of 324 dead bodies having any firearm injury were enrolled in the study. All the dead bodies subjected to autopsy with firearm injuries were checked for inquest report and death docket. Any dead body without proper documentation like unavailability of inquest report, inquest report not signed with a stamp and a dead body without police custody was excluded from the study. A predesigned autopsy proforma was used to extract the demographic variables like age, gender and locality. The pattern of firearms like the number of shots and velocity of the bullet was assessed during an internal examination. The velocity of the bullet was classified into two categories; one as a low-velocity weapon (<1000 feet per second [fps]) like a pistol, revolver, etc. and the other as a high-velocity weapon (>1000 fps) like a rifle, submachine guns, etc. Both of these weapons cause a different pattern of injury.[4] The demographic variables were taken as independent variables while the pattern of firearms including the number of shots and velocity of the bullet were taken as dependent variables.

STATISTICAL ANALYSIS

Statistical Package for the Social Sciences (SPPS) version 21.0 was the analytical tool for the data extracted. Mean±SD was calculated for numerical variables while frequency and percentages for categorical variables. Chi-square was applied for post-stratification significance among gender, age groups, locality and pattern of firearms. A p-value ≤0.05 was taken significant.

RESULTS

About 324(68.07%) cases presented as homicidal firearm deaths from a total of 476 autopsies, in which 269(83%) were males while remaining 55(17 %) were females making a male to female ratio of 4:1. The most common age of presentation was 21-30 years with 115(35.5%) cases followed by 31-40 years with 62(19.1%) cases and 11-20 years with 47(14.5%) cases, while 0-10 years and more than 70 years were least common with only 4(1.2%) reported homicidal cases. Among the cases, 177(54.6%) had multiple shots while 147(45.4%) had a single shot firearm homicidal injury. Out of total, 191(59%) were shot by a high-velocity weapon while 133(41%) by a low-velocity weapon. Regarding locality distribution, 241(74.4%) cases were rural based while 83(25.6%) were urban based.

Post-stratification significance between a few demographic factors like gender, age and locality was calculated with the pattern of firearms as shown in table 1. It was noted that gender and age group had a significant association with the number of shots with a p-value of 0.02 and 0.05 respectively, while locality

Table 1: Association of Demographic Factors with Pattern of Firearms

Demographic Variables		Pattern of Firearms							
		Number of Shots				Velocity of Bullet			
		Single	Multiple	x^2	p-value	High	Low	x^2	p-value
Gender	Male	114	155	5.72	0.02	162	107	1.060	0.303
	Female	33	22			29	26		
Age Group (Years)	0-10	4	0	13.92	0.05	3	1	7.651	0.364
	11-20	27	20			30	17		
	21-30	57	58			57	58		
	31-40	25	37			38	24		
	41-50	18	26			27	17		
	51-60	10	22			22	10		
	61-70	5	11			11	5		
	More than 70	1	3			3	1		
Locality	Rural	106	135	0.730	0.393	139	102	0.631	0.427
	Urban	41	42			52	31		

was found to be insignificantly associated with a p-value of 0.393. Analysis of the velocity of the bullet with the demographic factors showed an insignificant association with a p-value of >0.05. An association was also calculated between the number of shots and velocity of the bullet (Table 2) and a significant association of <0.001 was recorded.

A graphical representation of the relationship between age groups, velocity of the bullet and the number of shots is shown in figure 1.

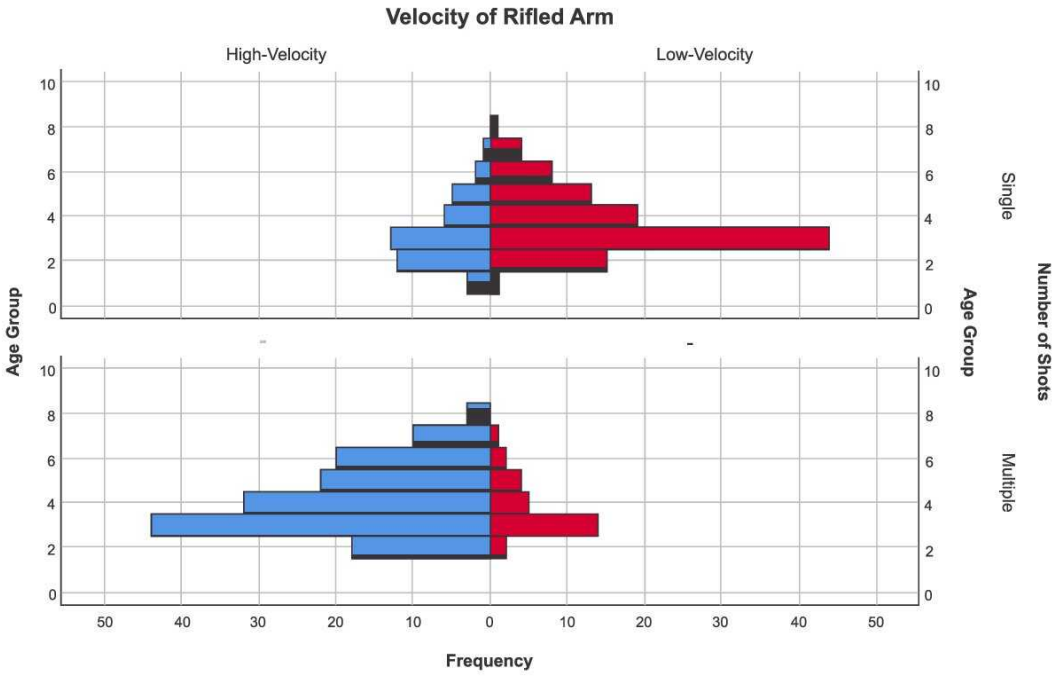
DISCUSSION

Manner of death is referred to as how death occurs and homicide is one of the commonest manners of death globally.[2] Based on World Health Organization reports, it is estimated that about 1.6 million people per year are killed due to violence, in which 1/3rd are homicidal in manner. According to the statistics, on average, about 1424 people killed every day are due to homicidal acts in which firearms is the most common one.[9]

Our study reported that 68.07% of firearms autopsies were homicidal. Similar results were observed in a study conducted in South Africa, which reported that the main category of deaths was firearm homicides dominating in 4 out of 5 cities. They also studied the pattern of homicides in the year 2001 to 2005 and found that the initial 3 years were dominated by firearm homicides and the later 2 years by non-firearm homicides.[10] Another similar study was conducted at the United States of America where the statistics showed a clear lead of homicidal killings as a cause of death over others in young people.[11] In another study at the United States of America from 2012-13 and 2015-16, the rate of homicide increased as compared to previous years and young age was more prone to

Table 2: Association of Velocity of Bullet & Number of Shots

Variable		Number of Shots			
		Single	Multiple	x^2	p-value
Velocity of Bullet	High	42	149	102.623	<0.001
	Low	105	28		



Age group: 2 = 11-20 years, 4 = 31-40 years, 6 = 51-60 years, 8 = more than 70 years

Figure 1: Relationship of Age Group with Velocity of the Bullet in Single and Multiple Shots

weaponry homicides.[12]

Our study indicated male preponderance showing 83% male cases reported from this part of the world. The female involvement, however, was only reported in 17% of the cases. These results are quite in similarity to a previous study conducted at Bahawalpur in 2000, where 87% of the cases were males while females were only 13%.[13] In another study conducted at Peshawar addressing the fatalities caused by gunshot injuries, a total of 200 cases were studied in which 172(86%) were males and 28(14%) were females presenting every 4/5 cases as males and 1/5 cases as females.[4] Comparing all these studies conducted within our country, the male preponderance is evident because of some obvious reasons like male dominance in our social sector. On the other hand, the female gender in our country is mostly confined to homes dealing with internal matters.[6,13] Mostly the activities of the females are house based so they get less outside exposure and hence are less prone to homicidal deaths.[14]

Our results showed that most of the homicidal deaths (35.5%) were in the age group of 21-30 years, which is the primary age of emotions, risk taking, accepting challenges and not thinking rationally making it a vulnerable age for homicides. Comparable results were found in a study by Matzopoulos et al. showing younger age (15-29 years) more prone to homicidal deaths (49.2%).[10] Another study conducted in India reported that during the period from 1992-1996 commonest age group of homicidal deaths was 21-30 years (38%).[15] Reza et al. while reporting on the epidemiology of violent deaths worldwide also showed the commonest age group as 15-24 years.[16]

This study revealed that the maximum number of deaths (59%) was caused by high-velocity weapons like kalashnikov, rifles, etc., whereas 41% deaths were caused by low-velocity weapons. Similar results were found in a study conducted at Peshawar by Hussain et al. which showed 92.5% deaths by high velocity weapons, either by rifled guns or short guns.[15] These results can be attributed to easy accessibility of high-velocity weapons in this society.

This study clearly shows rural areas leading the urban areas in terms of a higher number of homicidal deaths due to firearms. Migration, educational standards, lifestyle, advances in communications and overall development in urban areas are making educated people migrate towards urban settings while rural areas are getting worst day by day, justifying the rise in the number of homicidal cases in rural areas.[6] On the contrary, a study conducted in the United States, clearly showed more urban cases of homicidal deaths.[17]

Regarding the association of the number of shots with firearm homicidal deaths, it was reported that many deaths were caused by a multiple number of shots causing extensive damage and immediate death. Such deaths due to multiple shots exclude the chances of suicide because of the reason that suicide has mostly one shot injury. The results of this study exhibit consistent results with another study conducted in Italy showing prevalent multi-shot injuries.[18] The velocity of the bullet was also associated with the number of shots showing a significant relationship between the two patterns of firearms. The results are in similarity with a study conducted on 511 gunshot victims showing a higher odd ratio of 4.543 for large caliber (high-velocity) weapons and shooting outcome.[19]

Short duration and a small study sample were the limitations of this study. Awareness and psychological sessions of the general public can play its role to minimize homicidal deaths due to firearms.

CONCLUSION

The study concluded that the young males were more prone to homicidal deaths. People of rural areas seemed to be involved more in such cases, using high-velocity weapons and hitting with multiple shots. Among the demographic factors, only age group and gender were significantly associated with the number of shots; while locality had an insignificant association with the pattern of firearms. The velocity and the number of shots had a significant association.

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Original Article

Comparison of Efficacy of 50% Trichloroacetic Acid using CROSS Technique with Microneedling for the Treatment of Atrophic Acne Scars

Ireej Ehsan, Uzma Ahsan, Nighat Sultan

ABSTRACT

Objective: To compare the efficacy of 50% trichloroacetic acid (TCA) using chemical reconstruction of skin scars (CROSS) technique and microneedling for the treatment of acne scars.

Methodology: This was a quasi-experimental study with a total of 60 patients, aged 18 and above with grade 3 and 4 atrophic acne scars. Patients were grouped for their initial grade of acne scars on the basis of the Goodman and Baron grading system. A total of 30 patients were treated with 50% TCA using CROSS technique and 30 with microneedling. A total of 3 sessions one month apart were done. Pre and post treatment photographs were taken and the scars were graded again at the end of the last session.

Results: After 3 sessions of the TCA CROSS technique and microneedling, all the patients showed a decrease in grades of acne scarring. They were assessed using Goodman and Baron grading system. At the end of treatment sessions; all the patients demonstrated a decline in acne grades. Compared to the pretreatment proportions, the number of patients increased in group I, II & III, while it declined in group IV, due to improvement in acne grading. Response was significantly better in patients treated with microneedling ($p < 0.05$).

Conclusion: Microneedling is more effective in the management of atrophic acne scars.

Keywords: *Post-acne scars. 50% TCA. Microneedling. Atrophic acne scars.*

INTRODUCTION

Acne Vulgaris is a common dermatological disorder especially in individuals between 11 to 30 years of age.[1] Aetiology of acne is multifactorial and primarily incorporates excessive sebum production, colonization of propionibacterium and hyperkeratinisation.[2]

Clinical variants of acne can range from papulopustular to nodulocystic disease and can lead to permanent scarring. This poses a need for early intervention and adequate treatment to avoid complications.[3] A significant majority of patients have atrophic scarring due to collagen and fat destruction and a relatively smaller proportion have keloids.[4] Post-acne facial scarring is a psychologically distressing situation and is constantly a challenge to manage. There is a consistent feeling of low esteem and depression in the affected patients. Effective treatment and management with positive outcomes can facilitate them not only in improving the physical appearance but also has a positive impact on mental wellbeing.[3] Acne scarring can be classified on the basis of clinical appearance as well as on severity. A variety of classification protocols have been formulated in this regard. The most commonly used clinical classification protocol has been suggested by Jacob et al.[4] This suggests the grouping of scars into rolling scars, boxcar or punched out scars and ice pick scars.[4] Whereas for severity of acne scarring; classification proposed by Goodman and Baron's global acne scarring grading system is used. It incorporates a four-category system to grade acne scars. Severity progresses from macular scarring (grade 1), mild atrophic scarring that may be visible at a distance of less than 50 cm and can be masked by makeup (grade 2), moderate atrophic or hypertrophic scarring that is visible at 50 cm or greater and not masked by makeup (grade 3) and severe atrophic or hypertrophic scarring visible at a distance greater than 50 cm & is not covered by the makeup (grade 4).[5]

Several treatment modalities are available to improve the aesthetic appearance in this condition. These include a variety of invasive techniques, resurfacing procedures (dermabrasion, ablative laser treatment and chemical peels), use of nonablative laser, chemical peeling, dermabrasion, dermal fillers, autologous fat transfer electrodessication and collagen-induced therapy.[6]

Chemical peeling is a procedure where chemicals are applied to the skin to produce a minimum damage to the outer layers and speed up healing. It is a well-known procedure to treat acne scars with variable clinical outcomes after multiple peeling sessions.[7] Common side effects include transient erythema, tingling, burning and post-inflammatory hyperpigmentation

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especially in Asians. The most commonly used chemical peels for treating acne and acne scars are salicylic acid, glycolic acid, Jessner's solution, resorcinol and trichloroacetic acid.[8]

Among these agents, trichloroacetic acid (TCA 95-100%) applied precisely to acne scars results in enhanced collagen production in the dermis leading to a decrease in the depth of scars. The procedure is named as chemical reconstruction of skin scars (CROSS).[9]

Peeling with TCA using the CROSS technique, if carried out properly can be one of the most rewarding procedures in the management of acne scars. However, a high concentration of TCA is often associated with hyperpigmentation especially in individuals with darker skin types. Statistics pertaining to the efficacy of TCA peels in cross technique are variable, as different concentrations of TCA have been used by different researchers. Concentrations of as high as 100% have been used in the management of acne scarring,[10] while some authors found comparable results with lower concentrations of 50% TCA and much less adverse reactions.[9]

Literature review also supports the fact that in comparison to the other peeling techniques, CROSS has a lower risk of scarring and hyperpigmentation as it targets the scarred tissue precisely and spares the adjoining normal skin and adnexa.[10,11] In the local context, only a few studies with a limited number of patients have been conducted using a low concentration of TCA in the management of post-acne scarring.[11]

Dermaroller or microneedling is a fantastic and effective device to induce new collagen formation and has been used to treat wrinkles, acne scars, pigmentation and chickenpox scars. It is a part of percutaneous collagen induction (PCI) therapy and has been introduced in the treatment of atrophic acne scars in the recent past.[12] This procedure involves the use of a sterilized roller made up of a sequence of small, pointed needles to break through the epidermis.[13] These needles split the excess collagen in the upper dermis with consequent formation of more collagen under the epidermis and a resultant better cosmetic outcome.[14] Both the above-mentioned treatment modalities are being used in the management of acne scarring with variable results.[15]

Literature review, however, is sparse in finding a study comparing both the modalities. We, therefore, decided to compare the CROSS technique using 50% TCA with microneedling in patients with post-acne scarring with Fitzpatrick skin type IV & V. It is a unique study that will compare the efficacy of microneedling versus 50% TCA in patients with grade 3 and 4 acne scarring in the local context.

METHODOLOGY

This quasi-experimental study was conducted in the Department of Dermatology, Sharif Medical and Dental College, Lahore, after approval from institutional research and ethical review boards. A total of 60 patients with grade 3 and 4 atrophic facial scars of all three types (ice pick, rolling and boxcar scars) were enrolled in the study. The sample size was calculated using the WHO calculator for two groups for a difference in the proportion of 20% between the groups giving the significance of 0.05 and a power of 80%.

Patients of either gender and above 18 years were included in the study. Patients with active viral, bacterial and fungal infections on the treatment site, history of keloid/hypertrophic scar formation, use of oral isotretinoin in the last 6 months, known photosensitivity and patients on photosensitizing drugs like oral contraceptive pills or minocycline and pregnant patients were excluded. After obtaining informed and written consent, patients were enrolled in the study. A detailed demographic profile (name, age, sex) was recorded. Goodman and Baron grading system was used for recording the baseline grade of scarring. They were categorized into groups A and B following a random table.

In Group A, patients were treated with 50% TCA peel using the CROSS technique. They were advised to avoid sun exposure and apply sunblock in the day. As a pre-peel priming process, 0.05% tretinoin cream was applied for 3 weeks. It was stopped a week before the procedure. On the day of the peel, the patient was briefed to come with a washed face. Baseline photographs were taken and kept in record. The skin was cleansed with an alcohol swab to remove oil from the skin before the procedure. Fifty percent TCA was applied to the atrophic scar using a wooden toothpick, the applicator was held tightly in contact with the skin for 30 seconds and a uniform frosting at the site was the endpoint. If desired frosting was not achieved, the process was repeated after 2 minutes. Patients were instructed to wash their faces with water immediately after peeling. They were also instructed to start the pre-peel regimen after a week or when the crusts shed.[11] A total of three sessions were carried out at monthly intervals. At the end of the study, photographs were taken again to compare with the baseline. All information was recorded on a pre-designed proforma. Post treatment clinical evaluation was done by using the Goodman and Baron grading system.

Group B patients were treated with microneedling. The first step was to clean the treatment area with an alcohol swab, followed by the application of topical 10% lidocaine cream. Microneedling was carried out using

Dermapen®. With a light pressure, it was rolled on the treatment area in eight directions (vertical, up, down, horizontal, to the right, to the left and in both oblique planes). The appearance of pinpoint bleeding spots on the treatment area was taken as the endpoint for the session. The patients were instructed to apply antibacterial ointment and also use sunscreen during the day. A total of three sessions were carried out at monthly intervals. At the end of the study, the photographs were taken again and compared with the baseline. All information was recorded on a pre-designed proforma. After 3 sessions, patients were evaluated again clinically using Goodman and Baron grading system to calculate the post treatment grades. If a patient showed a 02 grade decline in pre treatment scarring grade; the response was considered to be "effective". Patients were also inquired about any side effects. The confidentiality of the data was ensured.

STATISTICAL ANALYSIS

Data entry and analysis was done by using Statistical Package for the Social Sciences (SPSS) version 23. Quantitative data like age was presented by using mean and SD. Qualitative data like gender and efficacy was presented by using frequency and percentages. Data was stratified for age and duration of disease to deal with effect modifiers. Post-stratification chi-square test was applied keeping a p-value ≤ 0.05 as significant.

RESULTS

A total of 60 patients with grade 3 and 4 acne scarring were included in this study. Socio-demographic details of both groups are shown in table 1.

In Group A, after 3 sessions of the TCA CROSS technique, all the patients showed a decrease in grade of acne scarring. No patient was left in grade 4. Thirteen patients upgraded to grade 1 and 8 upgraded to grade 2. Compared to pretreatment proportions, the number of patients increased in grades 1 & 2. In Group B, results were almost comparable. After 3 sessions of microneedling, all the patients had a decline in pre treatment grade of acne scarring (Table 2).

Stratification of data regarding age, duration of disease and baseline acne grading was carried out in both the groups and the results were compared. In intergroup comparison, the response to treatment was significantly better in the younger age group (<25years) and in patients with shorter duration of

Table 1: Study Variables of the Patients

Study Variables		Group A	Group B
Gender n (%)	Male	6(20%)	9(30%)
	Female	24(80%)	21(70%)
Mean Age (Years)		29.07±4.955	26.47±3.071
Mean Duration of Disease (Years)		1.63±0.490	1.77±0.430

Table 2: Comparison of Pretreatment and Posttreatment Acne Scarring Grades

Group A-TCA				
Grade	Pretreatment Grade		Posttreatment Grade	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
1	Not Enrolled	Not Enrolled	13(upgraded)	43.3
2	Not Enrolled	Not Enrolled	8(upgraded)	26.7
3	22	73.3	9	30.0
4	8	26.7	0	0.00
Group B-Microneedling				
Grade	Pretreatment Grade		Posttreatment Grade	
	Number (n)	Percentage (%)	Number (n)	Percentage (%)
1	Not Enrolled	Not Enrolled	23(upgraded)	76.7
2	Not Enrolled	Not Enrolled	3(upgraded)	10.0
3	18	60.0	4	13.3
4	12	40.0	0	0.00

scarring (1-2 years) in both the groups (Table 3). On the other hand, the intragroup comparison revealed a significantly better response in group B (Table 4 & Figure 1). The safety of the procedure was established by evaluation of the side effects during and at the end of treatment sessions. Both the procedures were well tolerated by the majority of the patients (86.66%) and only a small proportion (13.34%) reported transient redness and mild crusting in the first few days after the procedure, which resolved in a few days. Daily activities were not hampered due to the procedure and the majority of the enrolled patients got back to their regular jobs on the next day after the procedures. All the enrolled patients completed their treatment sessions with no dropouts.

DISCUSSION

Atrophic acne scarring occurs as a result of damage caused in and around the pilosebaceous follicles during active inflammation. A variety of treatment modalities are being used for the management of this psychologically distressing condition. Minimally invasive procedures are new modalities used for skin rejuvenation, tightening and scar remodeling. They act by augmenting the dermal extracellular matrix (ECM) proteins with minimal damage to the epidermis,

Table 3: Age & Duration of Disease Stratification and Comparison of Efficacy 50% TCA CROSS Technique & Microneedling

Age Stratification & Comparison of Efficacy					
	Age Years 18-25 Years	**Efficacy n (%)**	**Age Years 26-40 Years**	**Efficacy n (%)**	**p-value**
Group A (TCA)	18(60%)	16(88.8%)	12(40%)	3(25%)	<0.05
Group B (Microneedling)	15(50%)	14(93.3%)	15(50%)	12(80%)	<0.05
Duration of Disease Stratification & Comparison of Efficacy					
	Duration Years n (%) 1-2 Years	**Efficacy n (%)**	**Duration Years n (%) 2-4 Years**	**Efficacy n (%)**	**p-value**
Group A (TCA)	17(56.6%)	14(82.3%)	13(43.3%)	5(38%)	<0.05
Group B (Microneedling)	23(76.6%)	22(95.6%)	7(23.3%)	4(42%)	<0.05

Table 4: Comparison of Efficacy of TCA CROSS Technique and Microneedling

Groups	**Efficacy (%)**		**p-value**
	Yes	**No**	
Group A (TCA)	63.3	36.7	<0.05
Group B (Microneedling)	86.7	13.3	

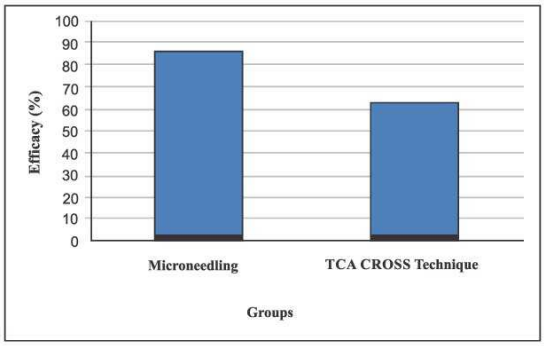

Figure 1: Comparison of Efficacy of TCA CROSS Technique and Microneedling

consequently reducing the side effects and downtime.[15,16]

Trichloroacetic acid peels are an effective treatment option for acne scars. To have fruitful results for atrophic scars, mid-depth peeling is strongly recommended. Commonly used TCA concentration of 15-25% results in superficial peeling and does not significantly affect deep boxcar and ice pick scars.[17] Higher concentrations TCA (95-100%) peels have been used in atrophic acne scarring with variable outcomes. However, it carries a risk of post-inflammatory hyperpigmentation in darker skin types. For that reason, we employed the CROSS technique, which involves the application of 50% trichloroacetic acid precisely on the depression of atrophic acne scars. The process results in the destruction of atrophic pit with consequent remodeling and condensed dermal collagen.[18,19]

Trichloroacetic acid CROSS technique at four weeks interval was found to be effective in 63.3% of our patients. Our results were in alignment with various local and international studies. Garem et al. in 2013 used 50% TCA CROSS technique for the treatment of atrophic acne and found that 63.3% of patients showed 50-70% improvement and 36.7% of patients showed 30-49% improvement in atrophic acne scars.[9] Agarwal et al. in 2015 carried out research utilizing 70% of TCA with CROSS procedure every 2 weeks. Almost 66% of his study population had >50% improvement. The dissimilarity in results could be due to different parameters for evaluation, which were more subjective.[20] In a local study by Aamir et al., using 35% TCA CROSS technique, the majority of patients had an excellent response.[11] There were minor differences in the number of the study population and outcome of clinical responses from all of the above-mentioned studies.

We also evaluated and compared the efficacy of microneedling with TCA peels. This economical and effective modality has the advantage of a downtime of only a few hours.[13] We carried out three sessions of microneedling at four weeks interval and found it effective in 86.7% of the patients. These results are analogous with most of the local and international literature. Varma et al. conducted a study in 2018 in Hong Kong. Out of 36 patients enrolled in their study, 50% had grade III scars, 38.88% had grade IV scars and 11.11% had grade II scars. After three sessions of microneedling four weeks apart, the proportion of patients with grade II scars had increased significantly from 11% to 38% (p=0.006), while the proportion of patients with grade III scars was almost the same (p=0.81) because nine cases with grade IV had improved to grade III. The proportion of patients with grade 4 decreased significantly from 39% to 14% (p=0.01).[21] Similarly, in 2014 Dogra et al. carried out a study on patients with post-acne atrophic scars, found that majority of the patients had a 50-75% improvement. He also had a subjective evaluation from patients using a visual analog scale (VAS). "Good response" was reported by 22 patients and "excellent response" was observed by the remaining four patients.[22] A literature review to compare both the treatment options was carried out. Puri in 2015 compared the efficacy of microneedling versus TCA using the CROSS technique in patients with atrophic acne scars. Almost 60% of the patients treated with TCA had marked improvement in cosmetic outcomes after four sessions, while 40% of patients in the dermaroller group were reported to have significant improvement.[23] This is in contrast with our results, where we found microneedling to be significantly more effective as compared to the TCA CROSS technique in the management of atrophic acne scars.

The minor differences in our results with these studies could be due to the use of different concentrations of drug, sample size bias, different study tools and time to reach optimum clearance and also difference between subjects.

LIMITATIONS

The result of this study needs to be seen in the context of its limitations. We relied on a small sample size and objective evaluation of the patients while comparing both the treatment modalities. However, the similarity of our results with previous work done across the globe suggests the generalizability of our results.

Future research is required with a larger sample size, long term follow-up of the patients and subjective evaluation by patients themselves on visual analogue score or patient satisfaction scores. Future studies can be conducted to compare microneedling with PRP or other modalities for acne scars.

CONCLUSION

Both microneedling and TCA CROSS techniques are effective and safe modalities in the management of atrophic acne scars. Microneedling, however, was found to be more effective and safe as compared to the TCA CROSS technique.

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Original Article

Comparison of Short Term Outcome of Three Surgical Techniques for the Management of Sacrococcygeal Pilonidal Sinus Disease

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ABSTRACT

Objective: To compare the short term outcome of three surgical techniques for the management of sacrococcygeal pilonidal sinus disease.

Methodology: This cross-sectional comparative study including 75 patients with sacrococcygeal pilonidal sinus disease was conducted in the Department of Surgery, Sharif Medical City Hospital, Lahore. Patients were divided into three equal groups (25 patients in each group) who underwent Rhomboid flap (Group I), Karydakis flap (Group II) and Bascom's procedure (Group III) for pilonidal disease. Operative and postoperative outcomes of the three surgical procedures were recorded and compared by one-way ANOVA.

Results: There were 71(94.7%) men and 4(5.3%) women with a mean age of 26.07±3.94 years. The commonest clinical presentation of sacrococcygeal pilonidal disease was discharging sinus (96%). Mean operative time was 53.03±10.98, 56.53±6.20 and 61.31±16.46 minutes in Rhomboid (Limberg) flap, Karydakis flap and Bascom's procedure, respectively. Earlier return to work was observed after Rhomboid flap surgery (14.91±3.03 days) than Karydakis flap and Bascom's procedure (18.53±4.92 and 17.36±4.73 days, respectively). There is a statistically significant difference in terms of operative time (p=0.0003), removal of wound drain (p=0.0001) and return to work (p=0.0002) in Rhomboid (Limberg) flap surgical technique as compared to Karydakis Flap technique and Bascom's procedure.

Conclusion: Rhomboid (Limberg) flap surgical technique was found superior to the Karydakis Flap technique and Bascom's procedure in terms of shorter operative time, earlier removal of wound drain and return to work.

Keywords: *Sacrococcygeal pilonidal disease. Karydakis flap. Rhomboid flap. Bascom's procedure.*

INTRODUCTION

The incidence of sacrococcygeal pilonidal disease is approximately 0.7% of the population and it is two to four times common in young males as compared to females because of sex hormones that act on pilosebaceous glands and body hair growth.[1,2] The pilonidal disease rarely occurs in older men. Hairy male and prolong sitting are the two commonest predisposing factors responsible for this disease.[3,4] Pilonidal disease was previously considered as congenital in origin but now it is accepted as an acquired condition because of the presence of hair. It can present as discharging sinus in natal cleft, pilonidal cyst or pilonidal abscess. The location of midline pits over the sacrum and coccyx is diagnostic of pilonidal disease.[5,6]

Various surgical techniques are established to treat this disease. Existing treatment options offer fast recovery, minimum hospital stay and lesser chances of recurrence of the disease. These include excision of all midline sinus tracts with or without primary wound closure and excision of sinus tract with flap closure. The commonly used surgical procedures are Bascom's procedure, Karydakis procedure, Rhomboid flap, Z-plasty and V-Y advancement.[7] However, the gold standard procedure for sacrococcygeal pilonidal disease treatment is not discovered yet because treatment options depend on the stage and clinical presentation of this disease.[8] The complications of treatment include recurrence, delayed or non-healing wounds, infection and failure of flap closure. Incomplete excision of sinus tracts, infection and midline scar are the factors responsible for the recurrence. To overcome the problem of recurrence, primary closure of the wound with flattening of the natal cleft is encouraged. To lessen the recurrence rate, off midline techniques are preferred surgical treatments of pilonidal disease.[9] The three frequently practiced off-midline methodologies are Rhomboid (Limberg) flap surgery, Karydakis flaps (lateral advancing flap) and Bascom's procedure.[10] These three technically complex remedial surgeries for treatment of sacrococcygeal pilonidal disease are single staged but are not free of complications. The main aim of all treatments is the satisfaction of patient along with the complete cure of the disease.[11,12]

The purpose of this study was to compare the short term outcomes of Rhomboid (Limberg) flap surgery, Karydakis flaps and Bascom's procedure surgical techniques for the management of sacrococcygeal pilonidal sinus disease.

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METHODOLOGY

This cross-sectional comparative study was conducted in the Department of Surgery, Sharif Medical City Hospital, Lahore. After approval from the hospital ethical committee, 75 patients with sacrococcygeal pilonidal sinus of either gender and above 16 years of age were enrolled in this study by nonprobability consecutive sampling. A valid informed consent was obtained after counseling the patients regarding the procedure & objective of the study. Patients with pilonidal abscess, diabetes mellitus, immuno-suppression, pregnancy and dermatological diseases were excluded from the study.

Patients were divided into three equal groups (25 patients in each group). Group I included patients who underwent Rhomboid (Limberg) flap surgery for pilonidal disease. Patients who underwent Karydakis Flap technique surgery were enrolled in group II. Group III had patients who underwent Bascom's procedure for pilonidal disease.

Demographic features, history and physical examination were noted. All procedures were performed under general anesthesia with standard surgical techniques for Rhomboid (Limberg) flap, Karydakis Flap technique and Bascom's procedure for pilonidal disease. All procedures were carried out with the patients in prone position and buttocks strapped apart.

In the Rhomboid (Limberg) flap technique, a diamond shaped area of skin was marked & excised up to pre-sacral fascia around the pilonidal sinus and covered with a surrounding fasciocutaneous flap over a vacuum drain in standard fashion.

Asymmetric elliptical area of skin was marked & excised up to pre-sacral fascia around the pilonidal sinus and defect was closed with fasciocutaneous flap over a vacuum drain in standard fashion in Karydakis flap technique.

In Bascom's procedure, pilonidal sinus tracts along with hair were removed through a lateral incision and openings of sinuses were excised via small incisions. The wound was closed primarily over a vacuum drain in standard fashion.

The operative time, hospital stay, removal of wound drain and return to work were noted in all three groups. The patients were followed-up postoperatively for 1 month for complications like wound infection, hematoma, seroma, flap necrosis or wound dehiscence. The recurrence was noted at a follow-up after 6 months.

STATISTICAL ANALYSIS

The data was entered into Statistical Package for the Social Sciences (SPSS) version 20 and analyzed. Quantitative data like age (in years), mean duration of surgery (in minutes), mean duration of wound drainage (in days), mean duration of return to work (days) and mean hospital stay (days) were presented as means and standard deviations. Gender, past history and clinical presentation, wound complications (hematoma, seroma, wound dehiscence, flap necrosis) and re-do surgery were presented as frequency and percentage. One-Way ANOVA test was applied to determine the statistical difference in three groups (p-value $\leq$0.05 was taken as significant).

RESULTS

Characteristics of patients and sacrococcygeal pilonidal disease are shown in Table 1. Seventy one (94.7%) patients were males. Seventeen (22.7%) patients had a past history of incision and drainage for pilonidal sinus. The most common clinical presentation of sacrococcygeal pilonidal disease was discharging sinus in the natal cleft (96%).

Mean operative time, duration of wound drainage, duration of return to work and duration of hospital stay are shown in table 2 and figure 1 & 2. There is a statistically significant difference in terms of operative time (p=0.0003), removal of wound drain (p=0.0001)

Table 1: Characteristics of Patients and Sacrococcygeal Pilonidal Disease (n=75)

Variables		No. of Patients (%)
Age (Years)	**Mean±SD**	26.07±3.94
	Range	21-32
Gender	**Male**	71(94.67%)
	Female	4(5.34%)
Past History	**Incision & Drainage of Pilonidal Abscess**	17(22.7%)
	Excision of Pilonidal Sinus without Flap Closure	6(8.0%)
	Excision of Pilonidal Sinus with Flap Closure	2(2.67%)
Clinical Presentation	**Discharging Pilonidal Sinus**	72(96%)
	Sacrococcygeal Pain & Tenderness	3(4.0%)

and return to work (p=0.0002) in Rhomboid (Limberg) flap surgical technique as compared to Karydakis Flap technique and Bascom's procedure. Complications of wound i.e. flap ischemia or necrosis, wound dehiscence, seroma, hematoma and wound infection were not observed in any patient. There was no recurrence of sacrococcygeal pilonidal disease after Rhomboid (Limberg) flap, Karydakis Flap technique

Table 2: Operative and Postoperative Outcomes of Surgical Flap Techniques (n=75)

Operative Outcomes	Rhomboid (Limberg) Flap	Karydakis Flap	Bascom's Procedure	p-value
Mean Operative Time (Mean±SD)	53.03±10.98 min	56.53±6.20 min	61.31±16.46 min	0.0003*
Mean Duration of Wound Drainage (Days)	6.34±2.91	8.01±1.30	7.58±3.05	0.0001*
Mean Duration of Return to Work (Days)	14.91±3.03	18.53±4.92	17.36±4.73	0.0002*
Mean Hospital Stay (Days)	3.02±1.42	4.79±2.51	4.54±2.90	0.301

***Statistically significant p-value**

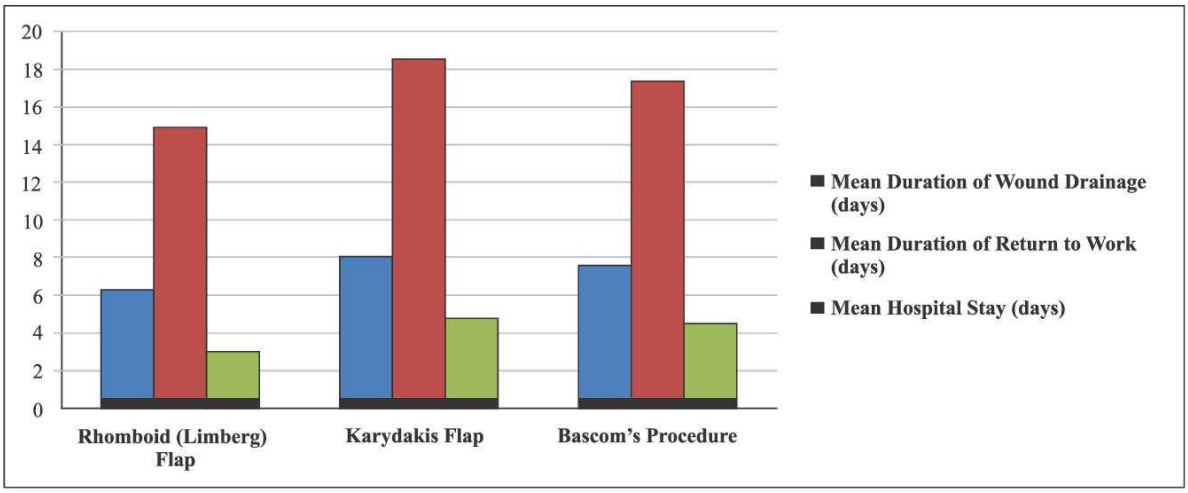

Figure 1: Surgical Outcomes of Rhomboid Flap, Karydakis Flap and Bascom's Procedure

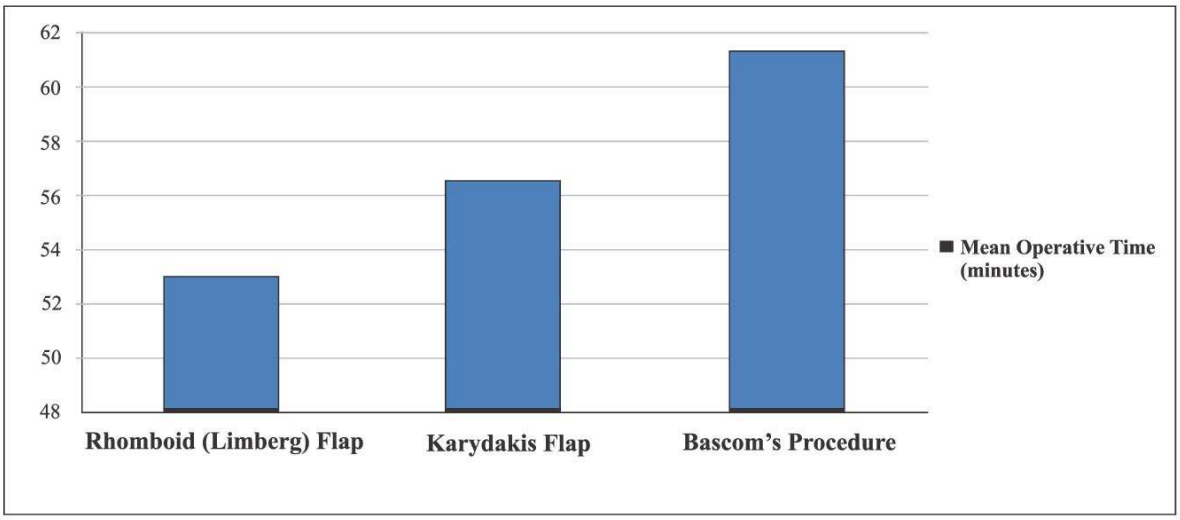

Figure 2: Mean Operative Time of Rhomboid Flap, Karydakis Flap and Bascom's Procedure

and Bascom's procedure in any case after surgery in group I, II & III.

DISCUSSION

Surgical excision of pilonidal sinus is the only satisfactory management for sacrococcygeal pilonidal disease in the literature. Reconstructive surgery has played a significant part in reducing the morbidity of this surgical operation over time.[13] This study was conducted on the surgical management of sacrococcygeal pilonidal disease which included 75 cases. In our study, patients in the second to third decade of life presented with pilonidal disease and the mean age of the patients was 26.07±3.94 years (range: 21-32 years). Similar results were found in other studies.[14,15]

In our study, male dominance was observed in 94.7% of the patients. The male dominance was also observed in a study by Karaca et al.[15] Similarly, the male dominance was also observed in a study by Rabea, i.e. 88% and 82% in the Bascom's cleft lift and Rhomboid flap groups, respectively.[14] This male predominance occurs mostly due to male hirsutisum.[11]

Our results showed that seventeen (22.7%) patients had a history of incision and drainage for pilonidal sinus. In another study, the past history of pilonidal abscess drainage was found in 36% and 30% patients in the Bascom's cleft lift and Rhomboid flap groups, respectively.[14] This shows that these patients were managed previously by conservative techniques. The most common clinical presentation of sacrococcygeal pilonidal disease in the current study was discharging sinus in the natal cleft (96%) followed by sacrococcygeal pain & tenderness (4.0%). A study conducted by Duman et al. in 2017 showed contrasting results in which the majority of the patients (924 out of 1258) of pilonidal sinus were asymptomatic without a history of drainage or abscess.[3]

Mean operative time for Rhomboid (Limberg) flap surgical technique was shorter i.e. 53.03±10.98 minutes as compared to the Karydakis flap technique (56.53±6.20 minutes) and Bascom's procedure (61.31±16.46 minutes) with statistically significant differences (p=0.0003) in our study. In another study by Karaca et al., the mean operative time was 45.3±11.3 and 33.5±15.7 minutes in Rhomboid (Limberg) flap and Karydakis flap technique groups (p<0.0001), respectively, the results were a bit contrasting to the current study.[15] Contrasting results were seen in another study which showed that the mean operative time was 40.78±11.96 and 61.14±16.36 minutes in the Bascom's cleft lift procedure and Rhomboid (Limberg) flap procedure (p=0.0001), respectively.[14] In a study conducted by Bali et al., the mean duration of operation was 54 and 48 minutes in Rhomboid (Limberg) flap and Karydakis flap technique groups (p=0.001), respectively.[16]

Our results showed that the mean duration of wound drainage was lesser in the Rhomboid (Limberg) flap surgical technique i.e. 6.34±2.91 days as compared to the Karydakis Flap technique (8.01±1.30 days) and Bascom's procedure (7.58±3.05 days) for sacrococcygeal pilonidal disease with statistically significant differences (p=0.0001). Another study found that the mean duration of wound drainage was 6±3.3 and 6±1.9 days in Rhomboid (Limberg) flap and Karydakis flap technique groups (p=1.000), respectively.[15] The results were almost similar to the current study.

The mean duration of return to work in our study was found shorter in the Rhomboid (Limberg) flap surgical technique i.e. 14.91±3.03 days as compared to the Karydakis Flap technique (18.53±4.92 days) and Bascom's procedure (17.36±4.73 days) for sacrococcygeal pilonidal disease with statistically significant differences (p=0.0002).

In our study, mean hospital stay was found shorter in Rhomboid (Limberg) flap surgical technique i.e. 3.02±1.42 days as compared to the Karydakis Flap technique and Bascom's procedure for sacrococcygeal pilonidal disease i.e. 4.79±2.51 and 4.54±2.90 days, respectively with statistically insignificant differences (p=0.301). Another study found that the mean duration of hospital stay was 3.18±1.36 and 3.66±1.75 days after the Bascom's cleft lift procedure and Rhomboid (Limberg) flap procedure, respectively (p=0.13).[14] According to another study, the mean length of hospital stay was found 1.44 days and 3 days in Rhomboid (Limberg) flap and Karydakis Flap technique groups, respectively (p=0.001).[16]

Rhomboid (Limberg) flap surgical technique was found superior to the Karydakis Flap technique and Bascom's procedure in terms of shorter operative time (p=0.0003), earlier removal of wound drain (p=0.0001) and return to work (p=0.0002).

Similar results were seen in another study which showed that the Rhomboid (Limberg) flap technique was a better treatment option. It had decreased operative time, early return to work, less postoperative complications & low recurrence rate.[17]

Rhomboid (Limberg) flap is easiest to construct and has good patient compliance as compared to other flaps such as Karydakis and Bascom. The Rhomboid (Limberg) flap is relatively sounder in drawing and easier in practice, even in the hands of junior surgeons. For these reasons, it is widely acknowledged by the surgeons.[13,15]

A study conducted in Bangladesh also showed Rhomboid (Limberg) flap technique had many advantages like less hospital stay, early healing with no

complications and recurrence.[18]
Furthermore, a multicentered study with a larger sample size should be conducted.

CONCLUSION

It is concluded that the Rhomboid (Limberg) flap, Karydakis Flap surgical technique and Bascom's procedures are safe surgical choices for sacrococcygeal pilonidal sinus disease treatment because of insignificant complications and recurrence rates. However, Rhomboid (Limberg) flap surgical technique was found superior to the Karydakis flap technique and Bascom's procedure in terms of shorter operative time, earlier removal of wound drain and return to work.

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Original Article

Effect of Plasma Chromium on Oxidative Stress Biomarkers in Pharmaceutical Workers

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ABSTRACT

Objective: To estimate the levels of chromium in workers of the pharmaceutical industry and its effects on the level of oxidative biomarkers.

Methodology: A cross-sectional comparative study was carried out on workers of two pharmaceutical industries named group 1 and group 2. A total of 48 workers working in two pharmaceutical industries that use chromium as an ingredient in drugs were included in the study. Twenty five healthy age-matched males were included in group 3 as controls. Estimation of serum chromium was carried out by Atomic absorption spectrophotometer. Levels of antioxidant enzymes were estimated by different standard chemical methods.

Results: Mean age of the study participants was 25.6±5.6 years in group 1, 32.5±2.4 years in group 2 & 30.1±6.3 years in group 3. Serum chromium level was 3.62±1.9 µg/L, 3.99±1.79 µg/L & 0.15±0.01 µg/L in group 1, 2 and 3, respectively. Serum chromium was significantly raised (p-value <0.0001) in group 1 & 2 as compared to controls (Group 3). No significant difference was found between group 1 and 2 (p-value=0.491). Levels of serum malondialdehyde (MDA), superoxide dismutase (SOD), glutathione (GSH) and catalase (CAT) were significantly increased in both group 1 & 2 as compared to controls (Group 3).

Conclusion: The significant effect of chromium level was observed on the oxidative stress biomarkers in workers working in all sections of the pharmaceutical industries.

Keywords: *Chromium. Pharmaceutical workers. Anti-oxidant enzymes. Malondialdehyde.*

INTRODUCTION

Chromium is a mineral and an essential trace element. Very small amounts of trivalent chromium are necessary for human health, however, hexavalent chromium is a toxin and can cause skin problems and lung cancer. Pharmaceutical workers are at risk of adverse health effects, including occupational asthma, pharmacological effects of drugs i.e. kidney and liver damage, cardiovascular problems, adverse reproductive outcomes and dermatitis. Workers working in pharmaceutical industries are exposed to pharmaceutical ingredients or active pharmaceutical ingredients (APIs) during their work. Such APIs may cause biological transformation in the body of workers.[1]

Work in the pharmaceutical industry is related to exposure to various hazards both chemical including organic solvent and physical including illumination, microclimate and noise. Organic solvents have a damaging effect on different systems of human organs. These have teratogenic, carcinogenic and mutagenic effects as well as an increased risk of developing heart diseases, respiratory diseases, arterial hypertension and chronic bronchitis. Their small size of molecules with no charge makes them easy to inhale. These are immediately absorbed through the gastrointestinal tract, lung and skin.[2]

The highest occurrence of problems due to the organic solvents has been observed in workers aged 40-49 years working in pharmaceutical industries for more than 20 years. However, it is observed that 73.4% of middle aged workers exposed to these intermediates of organic solvents are able to work.[3]

The antioxidative systems in the human body include both nonenzymatic and enzymatic systems. The nonenzymatic system includes carotenes, ά-tocopherol, ascorbic acid, etc. The enzymatic systems include catalase, superoxide dismutase, peroxidase, glutathione reductase, etc. In the living system, these free radicals are inhibited by antioxidants as these antioxidants convert free radicals into less reactive species.[4] During metabolic processes, the chromium undergoes oxidation/reduction reactions, can generate free radicals in the form of reactive oxygen species (ROS) that cause oxidative stress. Inhalation of hexavalent chromium Cr(VI)-containing particles, dust, mists and fumes is a common form of exposure and is associated with several respiratory diseases and others.[5] Different types of intracellular reductants help in the reduction of Cr(VI), which may increase the production of ROS and indirectly endorse oxidative stress by interacting with mitochondria. Reactive oxygen species damage the number of constituents of

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the cell including nucleic acids, proteins & lipids and cause an alteration in function and cell integrity.[6]

Hexavalent chromium is rapidly reduced by several chemicals and enzymatic reductants and ultimately converts into Cr(III) inside the cells resulting in toxicity. The species of Cr(III) are stable and insoluble and do not easily cross cell membranes and may be a major reason for inhibition of cell growth and killing of cell.[7] Enzymes having a significant role in protecting the cells from oxidant stress are catalase, superoxide dismutase and glutathione peroxidase. Superoxide dismutase is believed as the 1st line of defense against toxicity produced by oxygen due to its inhibitory role on the formation of oxy radicals.[8]

Catalase is an essential enzyme present in peroxisomes and is used for the defense cell system against oxidative stress. Catalase reduces the Cr(VI) induced toxicity in both cancerous and noncancerous cells and decreases the generation of the hydroxyl group, entailing a role for peroxides and hence varnishes the detoxification reaction started by superoxide dismutase. The increased expression of glutathione peroxidase degrades hydrogen peroxide (H_2O_2) and defends cells from the damaging effect of Cr(VI) i.e. it interacts with DNA in the presence of H_2O_2 and cause the breakage of strands of DNA.[9,10]

The incidence of oxidative stress can be described by the content of malondialdehyde. The MDA can form covalent bonds and can modify the functions of different molecules by inhibiting the activity of many enzymes. It also acts as an inhibitor of the replication process and has a role in the occurrence of respiratory problems.[11,12]

Oxidative stress biomarkers are very helpful in evaluating the health of workers working in the chemical and pharmaceutical industries. This study focused on the effect of chromium on the levels of oxidative biomarkers such as SOD, catalase, GSH and MDA.

METHODOLOGY

A cross-sectional comparative study was carried out on two groups of workers belonging to two different pharmaceutical industries in the Institute of Molecular Biology and Biotechnology, The University of Lahore. A total of 48 workers exposed to chromium at their workplace were included in the study. Group 1 included 22 participants working in one pharmaceutical industry and group 2 had 26 workers from another pharmaceutical industry. These industries use chromium as an ingredient in drugs. Twenty five healthy age-matched males were included in group 3 as controls. The study was approved by the ethical committee of the institution. Informed consent was taken from each participant. The questionnaire containing information regarding age and duration of work was filled before taking the blood sample. The participants who were under medical treatment for tuberculosis, cancer, serious heart, lung or kidney complications were excluded from this study.

A total of 3.0 ml venous blood samples were collected in heparinized plastic vials. The chromium levels were analyzed using atomic absorption spectrophotometer (normal chromium levels in the human body $\leq$1.4 µg/L). Estimation of catalase was carried out by the spectrophotometric method and malondialdehyde was measured by the thiobarbituric acid/reactive species method. Superoxidase dismutase was estimated by the adrenaline method and glutathione levels were performed by glutathione assay kit.

STATISTICAL ANALYSIS

Data for each participant was analyzed using Statistical Package for the Social Sciences (SPSS) version 21. Quantitative variables were expressed as mean±SD. Student's t-test was applied to compare the mean values of study parameters. A p-value of $\leq$ 0.05 was considered significant.

RESULTS

The mean age of the study participants was 25.6±5.6 years in group 1, 32.5±2.4 years in group 2 & 30.1±6.3 years in group 3. In group 1 the mean duration of work was 3.9±2.4 years and 4.3±3.1 years in group 2.

Serum chromium level was 3.62±1.9 µg/L, 3.99±1.79 µg/L & 0.15±0.01 µg/L in group 1, 2 and 3, respectively (Figure 1). Serum chromium was significantly raised (p-value <0.0001) in group 1 & 2 as compared to controls (Group 3). No significant difference was found between group 1 and 2 (p-value=0.491).

High levels of MDA were found in group 1 (3.76±0.64 µmol/L) and group 2 (4.1±0.84 µmol/L) as compared to group 3 (0.93±0.09 µmol/L). Statistically significant difference was observed in study subjects and controls (p-value <0.0001). Comparison of MDA levels in group 1 & 2 was insignificant (p-value=0.13).

Serum SOD was 0.22±0.07 mg/ml, 0.04±0.02 mg/ml & 0.06±0.01 mg/ml in group 1, 2 and 3, respectively. A significant difference (p-value <0.0001) was found when group 1 and 2 were compared to group 3. Levels of serum SOD were significantly increased with a p-value of less than 0.0001 in group 1 as compared with group 2.

In group 1 serum GSH level was 2.87±0.82 mg/ml and 3.00±1.1 mg/ml & 0.011±0.01 mg/ml in group 2 & 3, respectively. Comparison between group 1 & 2 was

insignificant (p-value=0.65), whereas highly significant p-value (<0.0001) was found on comparison of group 1 and 2 with group 3.

In group 1, 2 & 3 levels of serum CAT were 1.19±0.7 U, 0.41±0.23 U & 0.011±0.01 U, respectively. A significant difference was found when group 1 & 2 were compared with a p-value of less than 0.0001. Comparison of group 1 & 2 with group 3 was also statistically significant (p-value <0.0001).

Levels of serum chromium and oxidative stress biomarkers are shown in table 1 and figure 1.

DISCUSSION

Chromium compounds are widely used in industries including the pharmaceutical industry. Exposure to chromium is a great hazard.[13] This study was carried out on two groups of workers belonging to two different pharmaceutical industries. In group 1, the mean age of workers was 25 years with an age range of 20-28 years. In group 2, the age of workers was 32 years with an age range of 30-37 years. According to a study the age is related to the experience of work. The prevalence and incidence of diseases increase greatly with age. However, it is observed that a large number of workers with increasing age become physically weaker but mentally active.[14,15]

Our results showed that the levels of serum superoxide dismutase, glutathione and catalase were significantly increased in group 1 & 2 as compared to group 3. This shows that pharmaceutical workers are at risk of increased activity of their antioxidants against oxidative stress produced by chromium. Fawad et al. showed that hexavalent chromium (VI) persuades dose and time-dependent outcomes on DNA damage and their results are in line with our results.[16] Hexavalent chromium (VI) is a noncytotoxic agent but its reduction by enzymes in the body may generate free radicals. The intermediates which are produced from the reduction of

Table 1: Levels of Antioxidants and Chromium in Study Groups

Study Variables	Groups		
	Group 1 (n=22)	Group 2 (n=26)	Group 3 (n=25)
Serum MDA (µmol/L)	3.76±0.64	4.1±0.84	0.93±0.09
Serum SOD (mg/ml)	0.22±0.07	0.04±0.02	0.06±0.01
Serum GSH (mg/ml)	2.87±0.82	3.00±1.1	0.011±0.01
Serum Catalase (U)	1.19±0.7	0.41±0.23	0.011±0.01
Serum Chromium (µg/L)	3.62±1.9	3.99±1.79	0.15±0.01

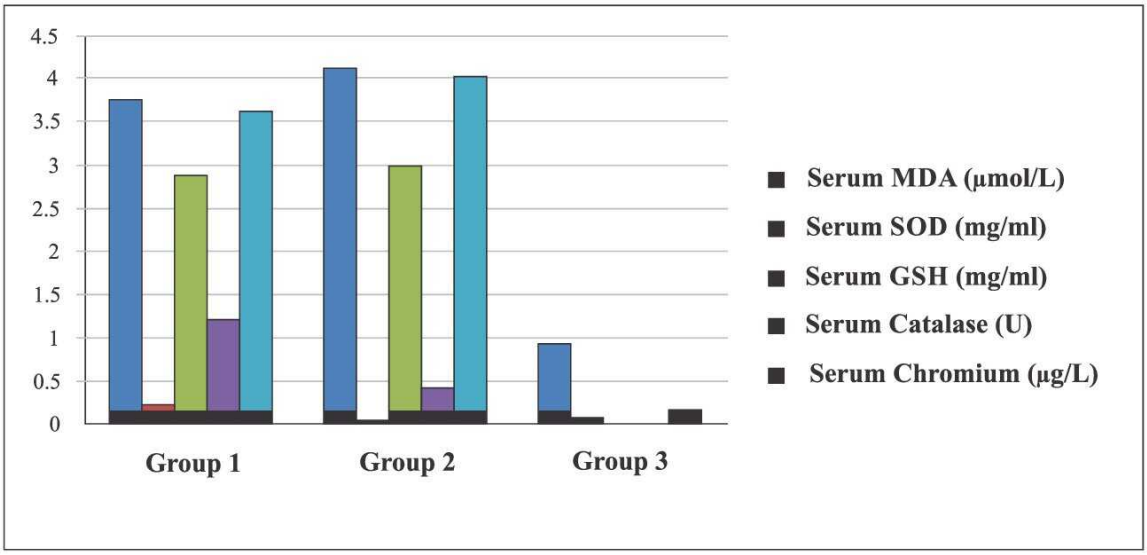

Figure 1: Levels of Chromium and Oxidative Biomarkers in Study Groups

chromium are thought to react with hydrogen peroxide (H_2O_2) to form the hydroxyl radicals, which may attack membrane lipids, DNA and proteins thereby altering the function of the cell and its integrity. Increased activity of catalase, superoxide dismutase and glutathione in the body demonstrates the important role of these enzymes in the protection of the cells from the harmful effects of chromium and chromium toxicity.[17]

A study was conducted in Poland to investigate the effect of chromium on antioxidant enzymes. According to that study, chromium was not significantly associated with SOD and GSH but it increased the lipid peroxidation.[13]

Sharma et al. experimentally proved that superoxide dismutase has a significant role in protecting cells from damaging outcome of hydrogen peroxide and it inhibits the production of ROS. The superoxide radicals (O_2^-) generated, are converted to H_2O_2 by the action of SOD. The accumulation of H_2O_2 is prevented in the cell by catalase, which reduces H_2O_2 into water. Catalases, therefore, take part in shielding cells against the damage caused by reactive oxygen species (ROS) to components of cells including nucleic acids, lipids and proteins.[18]

Glutathione reductase is required to keep a high ratio of the reduced form of glutathione from the oxidized form of glutathione. It is observed in a study that GSH causes an intra-cellular reduction of hexavalent chromium (VI) which is a hazardous toxin.[19]

We observed that the serum levels of malondialdehyde and chromium were high in group 1 & 2. A number of studies agree with our study. A study demonstrated that chromium enhances lipid peroxidation and the efflux of potassium. Lipid peroxides are unstable and give the reactive form of carbonyl compounds. Peroxides of polyunsaturated fatty acids produce malondialdehyde and the estimation of MDA may be used as a marker of lipid peroxidation.[20] Jan et al. suggested that heavy metals are the reason of oxidative stress and antioxidant enzymes have an important role in opposing oxidative stress. It is therefore said that antioxidant enzymes, efflux of potassium and lipid peroxidation help in monitoring of contamination with heavy metals.[21] Fawad et al. revealed that increased duration of exposure cause a higher amount of chromium absorption in the body. They found that MDA concentration of local tannery workers in Pakistan exposed to chromium was higher than those of controls.[16]

According to another study, elevated blood chromium levels in industrial workers as compared to the controls resulted in increased MDA levels. Serum levels of SOD and GSH remained unchanged.[22]

The present study included the consented workers of only two different pharmaceutical companies. There is a need to investigate the levels of antioxidants in workers of both renowned and un-renowned pharmaceutical companies to achieve a better conclusion. Most of the chemicals in working areas are not investigated for the types of diseases these chemicals can produce. It is therefore difficult to recognize accurately the hazards produced by different chemicals in workers of pharmaceutical industries.

CONCLUSION

A significant effect of chromium content was observed on the levels of oxidative biomarkers in two groups of pharmaceutical workers.

RECOMMENDATIONS

Precautionary means should be focussed on the decrease of hazards of occupation and bad working conditions as well as work protection. There is also a need of taking actions like hazard scrutiny, less use of toxic materials, proper ventilation, etc. to improve the working environment in pharmaceutical industries.

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Original Article

Effect of Vitamin D on Testosterone Levels in Male Albino Rats under Atorvastatin Administration

Maimona Tabbsum, Sana Akram, Hamid Javaid Qureshi, Chaman Nasrullah, Muhammad Jabran Javaid Sidhu, Jahanzaib Salim

ABSTRACT

Objective: To determine the effect of atorvastatin on serum testosterone levels and the effect of vitamin D on testosterone levels in atorvastatin taking male rats.

Methodology: It was a randomized control trial conducted in the animal house of Akhtar Saeed Medical & Dental College (AMDC), Lahore. A total of 90 male albino rats were taken and divided into three equal groups by random sampling technique. Group A was a control group, group B was given atorvastatin 10 mg/kg body weight per oral for 6 weeks and group C was given atorvastatin in the same dose plus vitamin D 100 ng/kg/day for 6 weeks. At the end of the 6th week, blood samples were taken through the cardiac puncture for serum testosterone levels. The significance of difference was calculated by one way ANOVA.

Results: Levels of testosterone were 3.90±0.192 ng/ml in group A, 3.10±0.343 ng/ml in group B and 3.47±0.748 ng/ml in group C. Testosterone levels were significantly decreased (p-value=0.000) in rats under atorvastatin administration (3.10±0.343 ng/ml) as compared to control rats (3.90±0.192 ng/ml). Testosterone levels were significantly raised (p-value=0.000) in rats treated with atorvastatin along with vitamin D supplementation (3.47±0.748 ng/ml) in comparison to those rats treated with atorvastatin alone(3.10±0.343 ng/ml).

Conclusion: Atorvastatin decreases serum testosterone levels and vitamin D ameliorates atorvastatin induced decline in serum testosterone levels.

Keywords: *Vitamin D. Testosterone. Atorvastatin.*

INTRODUCTION

Statins are first-choice cholesterol-lowering agents. Statins reduce the formation of cholesterol in the liver by blocking enzyme 3-hydroxy-3-methyl-glutaryl-coenzyme A reductase (HMG-CoA reductase). Among many side effects, decreased testosterone levels and loss of libido are also one of the side effects of statins.[1]

One of the major determinants of male libido is serum testosterone levels. Lowering the testosterone levels diminishes male drive. Testosterone is produced in males essentially in Leydig cells and the principal substrate is the cholesterol. The Leydig cells not only take cholesterol from the blood by utilizing the low-density lipoproteins and high-density lipoproteins receptors, but these also have the ability of de novo cholesterol synthesis.[2] In a recent study carried out on patients taking statins, who presented with erectile dysfunction, both total, as well as free testosterone levels were significantly lowered.[3]

Statins decrease testosterone synthesis by diminishing plasma LDL-cholesterol and bring down the total sum of cholesterol offered to the Leydig cells, thereby restraining the new formation of cholesterol in the testicles and inhibiting 17-ketosteroid-oxidoreductase catalyzed transformation of dehydroandrostenedione to testosterone.[4] Statins also inhibit the production of bile acids, corticosteroids and vitamin D.[5]

The relationship between statins and vitamin D is shown in figure 1. Formation of cholesterol as well as vitamin D required 7-dehydrocholesterol. Statins inhibit the HMG-CoA reductase enzyme which decreases 7-dehydrocholesterol levels.[6]

Vitamin D is one of the steroid hormones. The precursor of vitamin D is 7-dehydrocholesterol and is present in the skin. It is an intermediate product in the cholesterol pathway. Studies have shown that androgen and vitamin D levels are positively correlated, it means that decreased levels of vitamin D are related to decreased testosterone levels.[7] Testosterone levels are found to be raised after vitamin D supplementation. Vitamin D is responsible for the up-regulation of particular genes present in testis. One of the genes, adenosine triphosphate binding cassette transporter 1 (ABCA1), is expressed specifically on Sertoli cells. It is responsible for the regulation of cholesterol content in Sertoli cells. Down-regulation of the ABCA1 gene results in the significant reduction of LDL and especially HDL from Leydig cells, which is one of the major forms of cholesterol for the synthesis of steroidogenic hormones.[7,8]

The role of vitamin D in the synthesis of testosterone is also through osteocalcin.[9] Vitamin D receptor (VDR) is

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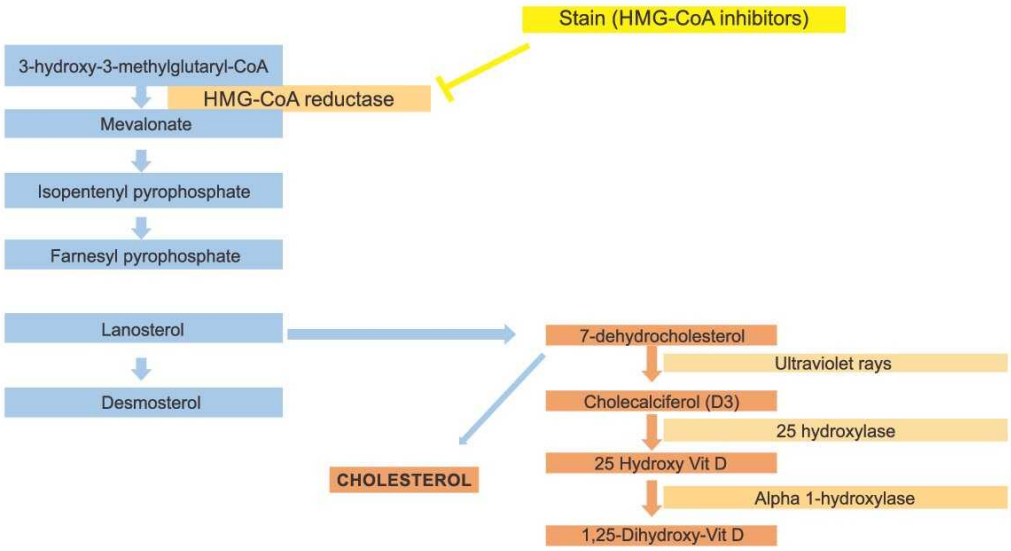

Figure 1: Possible Relationship between Stain and Vitamin D[6]

responsible for the role of vitamin D all over the body including reproductive tissues. It causes the metabolism of vitamin D in the male reproductive system including spermatozoa and testis. The presence of VDR in spermatozoa is considered to be responsible for good semen quality and it also causes an increase in the concentration of intracellular calcium that induces sperm motility.[10]

The rationale of the study focuses on the decline in male fertility due to the use of statins which amplifies the need for some drug or supplement that can boost up fertility parameters affected due to treatment with statins.

METHODOLOGY

It was a randomized control trial conducted in the animal house of Akhtar Saeed Medical & Dental College (AMDC), Lahore. This study was approved by the ethical review board of the college. A total of 90 male albino rats were taken and divided into three equal groups by random sampling technique. Animal house temperature was thermostatically maintained at 26±2˚C and a light/dark cycle. Adult healthy male albino rats, weighing approximately 200-300 grams were included while rats who were inactive or with some anomaly were excluded. Group A was the control group whereas group B & C were intervention groups. A normal diet was given to rats in group A. Group B was given atorvastatin and group C was given atorvastatin and vitamin D.

The dose of atorvastatin was10 mg/kg/day orally for 6 weeks.[11] Additionally, group C was also given the dose of vitamin D 100 ng/kg/day per oral route for 6 weeks.[12]

After 6 weeks, blood samples were taken through intracardiac puncture. Serum testosterone levels were measured by ELISA.

STATISTICAL ANALYSIS

The data was analyzed using Statistical Package for the Social Sciences (SPSS) version 23. Mean±standard deviation was calculated for testosterone levels. Statistical significance of testosterone amongst the three groups was determined by applying one way ANOVA. Post-hoc Tukey's HSD test was also conducted to calculate any significant difference among the two groups. A p-value of ≤ 0.05 was considered significant.

RESULTS

Levels of testosterone were 3.90±0.192 ng/ml in group A, 3.10±0.343 ng/ml in group B and 3.47±0.748 ng/ml in group C (Figure 2). Serum testosterone levels were significantly lower in group B rats, which were given atorvastatin as compared to the control group and these levels were increased in group C rats which were given atorvastatin along with vitamin D. There was a highly significant ($p = 0.000$) difference of serum testosterone between the three groups.

Testosterone levels significantly decreased ($p=0.000$) in rats of group B (3.10±0.343 ng/ml) as compared to control group A (3.90±0.192 ng/ml) (Table 1).

Similarly, the levels of serum testosterone in group C which was receiving atorvastatin and vitamin D (3.47±0.748 ng/ml) were significantly higher ($p= 0.000$) as compared to group B which was receiving only atorvastatin (3.10±0.343 ng/ml) (Table 1).

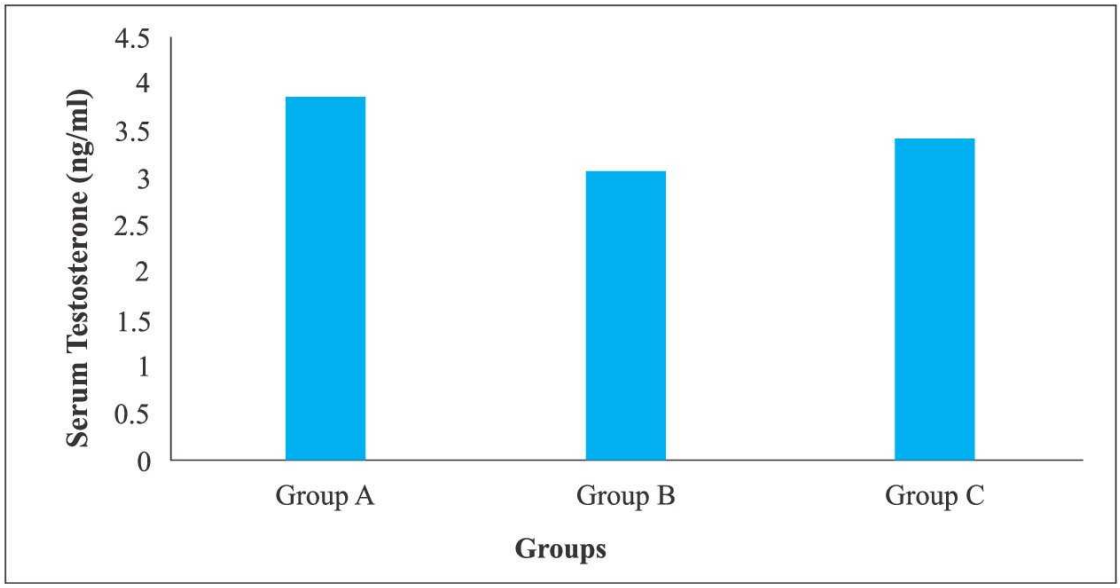

Figure 2: Bar Chart Showing Testosterone Levels in the Study Groups

Table 1: Comparison of Testosterone Levels between the Groups

Comparison of Group A & B			
Parameter	**Group A**	**Group B**	**p-value**
Serum Testosterone (ng/ml)	3.90±0.192	3.10±0.343	0.000*
Comparison of Group B & C			
Parameter	**Group B**	**Group C**	**p-value**
Serum Testosterone (ng/ml)	3.10±0.343	3.47±0.748	0.000*

***p=0.000, Highly Significant**

DISCUSSION

The present randomized control study was conducted on 90 male albino rats. The effects of atorvastatin along with vitamin D on serum testosterone levels were assessed. Our study showed a highly significant decrease (p=0.000) in serum testosterone levels in rats of group B given atorvastatin and significant increase (p=0.000) in testosterone levels in rats of group C given atorvastatin and vitamin D.

In a study, serum testosterone levels were analyzed by Corona et al., among the patients who were on statin treatment. After adjusting with confounding factor which was body mass index, both free and total testosterone levels were significantly decreased in subjects on statin therapy as compared to the controls.[3]

Previous studies have shown that statin therapy produces significant hypogonadism and it should be thought of as one of the possible factors while evaluating for low testosterone levels in men with erectile abnormalities.[13,14] Kanat et al., conducted a study that evaluated the effects of statin treatment on steroid synthesis in which atorvastatin was given in a dose of 80 mg which decreased gonadal steroids.[15] On the other hand, Kocum et al., showed that high-dose atorvastatin was found to be safe for gonadal steroidogenesis.[16] Another study conducted in the Netherlands concluded that decreased libido is probably an adverse effect of statins.[14] Our present study is most consistent with all those studies which have documented a significant lowering of serum testosterone levels with statins use. Our study showed that the rats who were on statin therapy had significantly lower serum total testosterone levels. This implies that physicians need to be very careful while starting statin treatment in patients who already have borderline or very low serum testosterone levels. Statin use may cause further decline in their serum testosterone levels and could affect their fertility. Statin

users are mostly older obese patients, having a higher prevalence of diabetes mellitus, coronary artery disease and hypertension.[17]

It has been identified that the male reproductive system is one of the target tissue for vitamin D. Pilz et al., studied a relationship between vitamin D & levels of testosterone in men. They evaluated the effects of supplementation of vitamin D on testosterone levels in men and included 200 nondiabetic subjects. Vitamin D was given daily for one year & its dose was 83 µg. At the start of the trial, the initial vitamin D values were deficient <50 nmol/l and levels of testosterone were found to be in the lower border of the reference range. Mean circulating vitamin D levels were significantly increased by 53.5 nmol/l in the group on vitamin D supplementation but in placebo group levels remained constant. There was a significant rise in total serum testosterone levels in the group which was on vitamin D supplementation. Initially, levels were 10.7±3.9 nmol/l and after vitamin D levels rise to 13.4±4.7 nmol/l ($p < 0.001$). On the contrary, no significant rise occurred in serum testosterone levels in the placebo group. Their results suggested that supplementation of vitamin D significantly increased levels of testosterone.[18] In our study, vitamin D was given and a similar improved effect on serum testosterone levels was observed.

Aykan et al. carried out a study in Turkey in which the levels of testosterone after giving atorvastatin (100 mg/kg) for 21 days to rats. Atorvastatin led to a decrease in testosterone levels ($p > 0.05$). After that vitamin D 0.2 µg/kg was given daily orally for 15 days. The administration of vitamin D increased the levels of testosterone as compared to the atorvastatin control group ($p > 0.05$).[19] Our present study also shows similar results after combined atorvastatin (10 mg/kg) and vitamin D (100 ng/kg) administration daily for 6 weeks. Further studies regarding the effects of statins and vitamin D on other fertility parameters which include sperm count, sperm morphology and motility are required in human subjects.

CONCLUSION

Atorvastatin decreases serum testosterone levels and vitamin D supplementation increases statins induced low testosterone levels.

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Case Report

Successful Renal Autotransplant after Complete Ureteric Avulsion during Ureteroscopy: A Case Report

Muhammad Rafiq Zaki, Mujahid Hussain, Tahir Mehmood, Nauman Ahmed, Rashid Naeem, Tashbeeb Gulzar, Tanvir Hussain

ABSTRACT

An eighteen years old male patient was operated for left upper ureteric stone with a plan of ureteroscopy and intracorporeal lithotripsy in a private hospital of Lahore. During procedure ureteric avulsion occurred, evident by entrapment of ureteric tissue on ureteroscope. Percutaneous nephrostomy (PCN) was done after this complication of ureteroscopy. On 2nd postoperative day, the patient visited our department at National Medical Centre, Defence Lahore. On his nephrostogram only 2-3 cm segment of proximal ureter was left. The patient was afebrile with normal range leucocyte count. After a discussion with the patient and his attendants, we planned for autotransplant which was done on the left side of the pelvis using cold ischemia along with PCN tube. The ureter was anastomosed with the urinary bladder in an extravesical mucosa to mucosa interrupted suture technique. The drain was placed and wound closed. The patient remained vitally stable. The drain was removable & the patient was discharged after 3 days. On the 5th post operative day, his PCN tube was blocked and Foley's catheter was removed on 7th post operative day. On the 10th post operative day, Doppler ultrasound was done which showed good perfusion, normal size and good corticomedullary differentiation of operated kidney. The PCN tube was removed on 12th post operative day and ureteral stent was removed after 4 weeks.

Keywords: *Ureteric avulsion. Autotransplant. Complication of ureteroscopy.*

INTRODUCTION

Ureteric avulsion is an injury of the ureter which occurs due to acute deceleration or acceleration movements during road traffic accidents as renal pelvis can be torn away from the ureter.[1] With invention of ureteroscopy, ureteric avulsion can also occur as a consequence of forceful manipulation of a large or impacted stone. Perhaps ureteric avulsion is the most catastrophic complication of ureteroscopy which is rarely reported in less than 0.06% to 0.5% of all cases.[2] Ureteric avulsion can also occur during withdrawal of ureteroscope if too large rigid ureteroscope is forcefully advanced up in the ureter. This avulsion is most common in the proximal part of ureter because it has the least muscular tissue support. This complication is usually diagnosed when a portion of ureter is withdrawn from the patient along with stone basket or grasper. There are so many maneuvers to avoid ureteric avulsion during ureteroscopy like avoidance of blind basketing, use of safety wire and use of small caliber ureteroscope. The urologist should be aware of safety measures, possible complications and their management during ureteroscopy.

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There are so many ureteral reconstruction techniques for ureteric avulsion which depend on the location of injury and the amount of viable ureter that remains. Among these techniques for lower and middle ureter ureteroneocystostomy with or without psoas hitch, boari flap and transureteroureterostomy are commonly used.[3,4] In stone former transureteroureterostomy is contraindicated. For proximal ureteric avulsion options include ileal interposition, renal autotransplant and graft ureteroplasty.[4,5]

Renal autotransplant is a safe method for dealing with complete avulsion of the ureter.[6] In this case, we report a successful renal autotransplant in young adult who got complete ureteric avulsion with only 2-3 cm ureter in the renal pelvis.

CASE REPORT

An 18-year-old young boy experienced left flank pain radiating to groin along with nausea and vomiting for a week. His ultrasound KUB (kidney, ureter, bladder) and intravenous urography (IVU) were advised by an initial operating urologist (Figure 1). On ultrasound, there was 11 mm stone in proximal ureter with moderate hydronephrosis. Plain X-ray KUB revealed radio-opaque opacity on the left side in ureteric line and further contrast films showed obstruction in proximal ureter distal to pelvi-ureteric junction. Accordingly the patient was planned for left ureteroscopy and intracorporeal lithoclast of ureteric stone. Most probably due to narrowing of the ureteral lumen, large caliber ureteroscope or forceful manipulation of impacted stone there was avulsion of ureter on

withdrawal of scope. The avulsed ureter was entrapped on the ureteroscope which came out along with ureteroscope (Figure 2). According to attendant and patient, immediate percutaneous nephrostomy tube was passed. On 2nd day the patient visited us and the nephrostogram of the patient was done through his PCN tube. Nephrostogram revealed only a 2-3 cm segment of the remaining proximal ureter and extravasation of contrast from the avulsed ureter (Figure 3). Various possible methods to treat ureteric avulsion were discussed and finally, renal autotransplant was considered as a salvage procedure. On 3rd day after ureteric avulsion, renal autotransplant was performed as the patient was afebrile with normal leucocyte count. The patient was put in the left flank position. With left intercostal incision nephrectomy was done and subsequently kidney along with PCN tube was shifted to ice slush. Flushing of the kidney, ligation of perivascular lymphatics and viability of remaining ureter were checked. Avascular, necrotic tissue of ureter was excised. Gibson incision was given on the left side of the pelvis and dissection of iliac vessels was done.

The renal artery was anastomosed to the internal iliac artery and renal vein to external iliac vein. There was 2-3 cm viable ureter so extravesical, mucosa to mucosa interrupted suture technique anastomoses over 4 French double J stent (DJ) with urinary bladder was made. After releasing vascular clamps, urine started to come out immediately through the PCN tube and the kidney was pinkish as shown (Figure 4). The PCN tube was secured, the drainage tube was inserted in wound and the surgical wound was closed. The patient remained vitally stable with adequate urine output in the PCN tube & Foley's catheter. On 5th day, the patient's PCN tube was blocked and Foley's catheter was removed on the 7th day. On the 10th day, Doppler ultrasound was done which showed normal arterial and

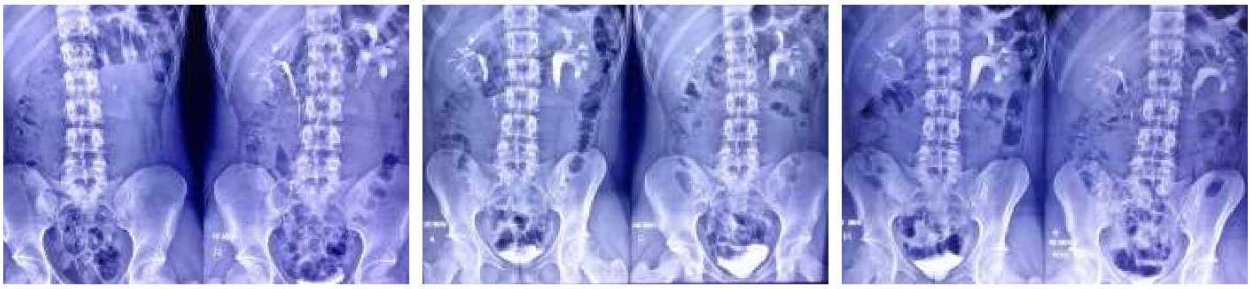

Figure 1: Intravenous Urography of the Patient before Surgery

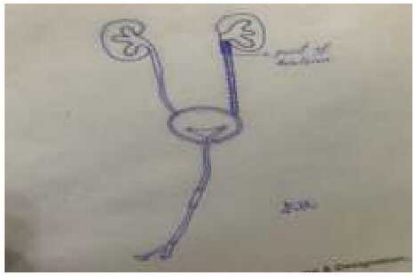

Figure 2: Diagrammatic Presentation

Figure 3: Nephrostogram after Ureteric Avulsion

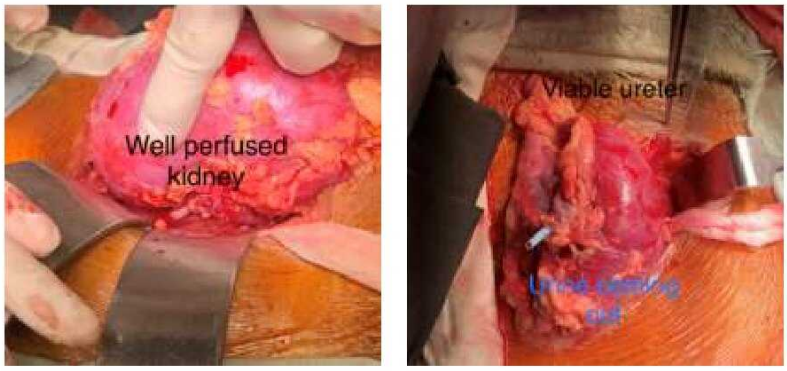

Figure 4: Operative Surgical Pictures

Figure 5: Doppler Ultrasound

venous flow (Figure 5). The mean parenchymal arterial vascular resistance was in the normal range. The height, anteroposterior diameter and cortical thickness were in the normal range. The values of urea and creatinine were also in normal range. The PCN tube was removed on 12th day. The ureteral stent was removed after 4 weeks cystoscopically. Future plan will include Doppler ultrasound at 6 months, 12 months and then according to the patient's status.

DISCUSSION

There are many indications for ureteroscopy including intracorporeal lithotripsy, resection of malignant tumors and diagnosis of unclear hydronephrosis. This procedure is not without complications. During this procedure late complications like urethral mucosal trauma, hematuria, ureteric perforations, ureteric avulsion and ureteral stenosis can occur. Among these complications of ureteroscopy, ureteric avulsion is most catastrophic. Although ureteric avulsion during ureteroscopy is a rare complication that occurres in less than 0.06% to 0.5 % of all cases.[7] The most common cause of ureteric avulsion is stone manipulation with a basket but nowadays blind basketing is not considered for stone extraction. The increasing miniaturization and improvements in ureteroscopy have led to a rare chance of avulsion. Most probably the cause of ureteric avulsion in our case was narrowing of ureteric lumen. With the use of small caliber ureteroscope, the use of safety wire and gentle manipulation can avoid this catastrophic complication. So, if this complication occurs then appropriate decisions and in time surgical intervention can prevent the need for nephrectomy and possible future complications. There are so many factors on which the best management of ureteric avulsion depends which include the age of the patient,

the physical condition of the patient, condition of affected kidney and length of remaining ureter.[8] Various surgical approaches are used for the management of ureteric avulsion. Psoas hitch technique is used to bridge defects of the lower third of ureter while the Boari flap technique is used when the diseased ureteral segment is too long but it cannot cover when the whole of the ureter is avulsed. Transureteroureterostomy is contraindicated in stone formation. Valid options for complete ureteric avulsion include graft ureteroplasty, ileal interposition and renal autotransplant. Ileal interposition is not without complications and includes electrolyte disturbance, stone formation and malignancy arising from ileal ureter segment.[7] Expertise for graft ureteroplasty is limited so in the absence of the above methods, renal autotransplant is a vital method.[4] Experts suggest that if ureteric injury is discovered immediately within 72 hours, it should be repaired. Injuries discovered after 3 days should be drained with stent, PCN or both and definitive repair should be done after 6 weeks.[7,8]

CONCLUSION

As we know ureteric avulsion during ureteroscopy is unwanted and catastrophic complication so its effective management requires rapid establishment of continuity of avulsed ureter. These surgical procedures need substantial surgical expertise along with suitable physical conditions of the patient. Timely and accurate decision making is also important for the management of this complication of ureteroscopy. Although percutaneous nephrostomy is an effective and safe approach but its effect on quality of life and post surgical complications unfavours its use as a first line option. Alternative to this, immediate and direct repair produces favorable outcomes. Autotransplant was done in our patient after discussing different options as there are multiple clinical evidences to support the accomplishment of a successful outcome.

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