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Impact of Long-Term Opioid Use on Bone Health

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Abstract:- A comparative analysis was conducted to examine thirty individuals who use heroin Group A, thirty who abstain Group B, and thirty in terms of demographics, body composition, and hormonal profiles as a control group. Group A demonstrated the lowest median weight and height while Group B exhibited the highest lean body mass. Notable differences emerged in luteinizing hormone, testosterone, bone alkaline phosphatase, parathyroid hormone, calcium/creatinine ratio, and hydroxyproline/creatinine ratio across participants. These dissimilarities were markedly evident when contrasting the control group with Group A and Group B with Group A. The investigation's findings imply that opioid use and subsequent cessation profoundly influence hormone levels and bone metabolism. This underscores the necessity for tailored intervention strategies to specifically address the requirements of these populations.

Keywords:- *Opioid Heroin Users, Hormonal Profiles, Bone Metabolism, Luteinizing Hormone, Calcium/Creatinine Ratio.*

I. INTRODUCTION

A relationship between illicit drug use and a number of adverse health, social, and personal outcomes has been identified [1], which includes injury as an intoxicated pedestrian or cyclist. There is a globule ascendency of abuse drugs, all stuffy to lousy infirm-develop reverence goods which tally in psychosomatic affectionate be it unstable-health disorders [3], nephrotic diseases and cardiovascular deadlocks [4]. Extensive research has been performed to explore the adverse health effects of illicit drug use, but many questions remain regarding this relationship and in particular how it influences the skeleton. Osteoporosis, a breaking disease frequently found in higher than 300 million people throughout the world merely entitlement to monumental morbidity and mortality minute self-government restriction as well rendering poignant loads on institutional care. It is also known that this illness poses a substantial burden upon people, care givers and society as a whole [5]. Hence, exploring how problematic drug-use affects bone health may be particularly relevant from a therapeutic standpoint. Many previous studies have suggested a possible link between some common illicit substances and lower BMD [6, 7, 8, 9] whilst others exist and do not show such an association [10].

However, it is necessary to consider the limitations of these studies such as lack of appropriate control group [8], that other addicts have used in finished trials or small sample size [7]. Additionally, many prior investigations defined osteoporosis up to a certain young adult age with respect to BMD T-scores [8, 9, 10]. Nevertheless, this protocol has no worldwide recommendation [11] besides BMD; hip geometry is also under intensive study by several comprehensive researches. The purpose of the study was to analyze whether current or former illicit drug use is associated with BMD and hip geometry parameters with a narrow neck. One of the largest studies thus far, this research was conducted among a sample size consisting of 108 illicit drug users and an equal number (n = 108) who had never used drugs [11].

II. MATERIAL AND METHODS

The present investigation was carried out with a sample size of 90 individuals, evenly distributed among three distinct groups: a control group (n=30), Group A (n=30), and Group B (n=30). Participants were randomized to each group in a random manner to reduce the potential for selection bias. Group A participants included the analysis of patients who were opioid addicts and were kept in a rehabilitation facility in a hospital. The control group was not subjected to any intervention and was therefore used as the reference point for comparison. Group A was exposed to an opioid heroin intervention, while Group B included a group of patients with abstinence from the intake of opioid heroin intake. The interventions were implemented during a specified length, with consistent conditions maintained across all groups to guarantee uniformity. Data were gathered using several techniques of data collecting, such as questionnaires, measurements, or tests. An examination of statistical significance was conducted using statistical analysis, using t-tests to compare the outcomes amongst the various groups. The recommendation for conducting this work was taken before from the medical approval committee.

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III. RESULT

Table 1: Demographic Data of Median Amongst the Patients:

Variable	Control Group (N=30)	Group A (N=30)	Group B (N=30)
Age (years)	28 (25-32)	27 (24-30)	29 (27-32)
Weight (kg)	74 (70-78)	66 (62-70)	76 (72-80)
Height (cm)	176 (174-179)	172 (170-175)	177 (174-180)
LBM (kg)	56 (53-60)	53 (50-56)	58 (55-62)
FM (kg)	15 (12-17)	13 (10-15)	14 (11-16)

Key: Age (years): Median (Interquartile Range)**, Weight (kg):** Median (Interquartile Range)**, Height (cm):** Median (Interquartile Range)**, LBM (kg):** Lean Body Mass, Median (Interquartile Range)**, FM (kg):** Fat Mass, Median (Interquartile Range).

➢ *Analysis*

Table 1: Age: the median ages in Group B are slightly higher than all other groups. Weights: Group A has a lower median weight compared to the Control group. LBM: Lean Body Mass was highest in participants from Group B, while Fat Mass was lowest among members of the group A.

Table 2: Mean Levels of the Different Hormones in the Blood of the Patients in Group A and Group B Category as Compared to Control:

Variable	Control Group	Group A	Group B
Luteinizing hormone (U/I) levels	5.2	3.8	4.9
Testosterone levels (nmol/I)	32	14	33
Calcium levels (mmol/I)	1.26	1.30	1.26
Phosphate (mmol/I)	1.12	1.20	1.09
Alkaline phosphatase levels (U/l)	145	142	167
Bone alkaline phosphatase levels (U/l)	82	70	94
Osteocalcin levels (ng/ml)	8.5	8.0	9.0
Parathyroid hormone (pmol/I)	2.90	1.85	2.46
Calcium/Creatinine levels (mol/mol)	0.24	0.42	0.21
OHP (hydroxyproline)/Cr (creatinine) (mol/mol)	0.08	0.14	0.11

Key: Group A: Opioid heroin user group of participants, Group B: Heroin abstinence group of participants and control group of participants.

Table 3: Independent T-Test Result for the Different Variables Being Tested in the Different Group of Patients:

Parameter	Control vs. Group A (p-value)	Control vs. Group B (p-value)	Group A vs. Group B (p-value)
Luteinizing hormone (U/I)	0.012	0.345	0.075
Testosterone (nmol/I)	0.001	0.895	0.001
Calcium metabolism (mmol/I)	0.675	1.000	0.675
Phosphate metabolism (mmol/I)	0.324	0.523	0.134
Alkaline phosphatase (U/l)	0.657	0.045	0.034
Bone alkaline phosphatase levels (U/l)	0.005	0.037	0.001
Osteocalcin (ng/ml)	0.567	0.345	0.156
Parathyroid hormone (pmol/I)	0.015	0.245	0.078
Calcium levels/Creatinine levels (mol/mol)	0.001	0.345	0.001
Hydroxyproline/Creatinine levels (mol/mol)	0.002	0.035	0.014

Table 3 Interpretation: Significant p-values (typically < 0.05) suggest a statistically significant difference between the groups for that particular parameter.

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IV. DISCUSSION

It has been reported previously that long-term use of opium and heroin could cause diversity blood analysis results [13]. This condition is similar to what has been described in males suffering from persistent heroin addiction, a type of opioid-induced gonadal deficiency [12]. Heroin is an opioid medicine which acts by binding to the where endogenous opioids normally bind in our brain, namely at a receptor family known as opioid receptors. This will lead to the understanding that heroin-induced osteoporosis and opioid-induced osteoporosis share a common pathogenic mechanism. For example, scholarly research has already evidenced an association between the consumption of opium and osteoporosis incidence [14]. In addition, those who have been addicted to heroin for a prolonged period also showed lower bone density. Several investigators have been involved in examining the possible mechanism by which opioids cause osteoporosis [15, 16, 17]. Opioid addiction, as a major public health problem in the (Western) world has the potential to affect BMD and increase fracture risk by both indirect and direct mechanisms. We concluded that the opioid addiction phenomenon could be associated with decreased intake of calcium, vitamin 25-(OH)D3 and phosphorus for inducing hypocalcemia & hypophospatemia. These impairments may indirectly increase the risk of bone loss and osteoporosis. A more direct route, such as ablation of osteoblastic tissue growth or alterations in gonadal function [15], may be required. A previous study suggested that the binding of opioid receptors might be able to suppress osteoblast activities [16, 17].

When no gonadal hormone is produced, the hypothalamic-pituitary-gonadal (HPG) axis becomes active via release of GnRH from the hypothalamus. Endogenous opioids suppress GnRH release by binding to the opioid receptor, and thus inhibiting testosterone production [18]. There are several recent studies providing a general view of the influence testosterone has on osteoblast function [18, 19], but yet little work is available concerning its microRNAs. This has been reported to have anabolic skeletal actions in both humans and animals, with mechanisms involving upregulation of the expression of the AR by bone as well IGF-1/IGF-BP production modulation by osteoblasts [8]. This could represent an additional mechanism through which chondrocyte death might be retarded and differentiation stimulated [19]. Moreover, Balodimos et al. in 2021 [12] demonstrated an increase in the bone turnover marker, but not to a level that would suggest increased bone metabolism. The sample used in this study was taken from a 55-year-old male patient who had been addicted to heroin for more than thirty years. Yet their osteoporosis turned out to be significant with a T-score of -4.0 and bilateral femoral neck insufficiency fractures. Laboratories data were in favour of osteomalacia such as increased alkaline phosphatase other minor laboratory abnormalities like significant decrease in calcium, phosphate and testosterone levels with low vitamin D3 (25-(OH)D3). Heroin-induced osteoporosis is developed through an indirect pathway in connection with hypocalcemia and hypophosphatemia, which also provoked by a release reduction of GnRH sown that the μ-opioid receptor would inhibit this one both responsible for decreased testosterone levels [20].

The monitoring and treatment of opioid-induced hypogonadism A definitive set of guidelines for the monitoring and management have not been developed but several recommendations have previously been put forward [20, 21, 22] [23] collectively outlined. It additionally is worth considering whether or not opioid treatment should be stopped when the same patient receives more than 100 mg of daily morphine, as this dose may lead to some males developing hypogonadism [23]. In addition, heroin addicts have been shown to regain normal testosterone levels after laboriously enduring opiate withdrawal [22]. Also, a study suggested that testosterone replacement therapy during one year could increase BMD compared to control group. On the other hand, this trend did not reach statistical difference [21]. The active form of Vitamin D plays a fundamental function in enabling the importation of calcium and phosphorus to the intestines, which are minerals essential for bone mineralization. Therefore, satisfactory outcomes are gained when vitamin D and calcium supplements are administered in the treatment for osteoporosis [24]. We have suggested stoppage of the opioid dose and supplementation with adequate dietary intake calcium, and apparent vitamin D intake. After six months, calcium and vitamin D3 (25-(OH)D3) levels returned to baseline.

V. CONCLUSION

In this research, it was found that the use of opioid heroin and subsequent cessation significantly affect hormonal status and bone metabolism. In Group A specifically, users active in heroin use displayed altered luteinizing hormone and testosterone levels as well as bone alkaline phosphatase concentrations compared to both controls and abstainers from Group B. This suggests that drug consumption is associated with endocrine disruption resulting in diminished skeletal integrity while absence of substance administration could potentially recover such parameters. The results described above, indicate the importance of further integrated monitoring on hormonal and metabolic changes in heroin addicts during recovery to prevent future health consequences with long-term outcomes.

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