Ergonomic risk assessment in pathology laboratory technicians
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ABSTRACT

ABSTRACT: The study aimed to conduct Ergonomic Risk Assessment amongst Pathology Laboratory Technicians by Using Pre - Validated Questionnaire & RULA (Rapid Upper Limb Assessment) Worksheet in order to identify the risk for development of job related Musculoskeletal Disorders in these subjects. Method: A cross-sectional study was conducted amongst 100 Pathology Laboratory Technicians in Mumbai with help of pre-validated questionnaire & RULA employee worksheet. Result: Work related musculoskeletal problems were strongly associated with poor ergonomics at workstation. The major complaints were job related musculoskeletal pain(87%), fatigue(41%), stiffness(40%). Commonest were low back pain(53%), neck(39%), wrist(21%), shoulder(21%), heel(14%) & knee(10%) respectively. Conclusion: According to the Rapid Upper Limb Assessment score, majority of the subjects were exposed to ergonomic risk factors such as (awkward postures, high frequency and prolonged work duration & static muscle work)

INTRODUCTION

U.S. National Institute of Occupational Safety and Health (NIOSH) in their definition states, ergonomics as designing the workplace and tasks to fit the capabilities of the working population. It is a relentless pursuit and continuous effort to design the workplace for what people do well, and design against what people does not do well, thereby fitting the job to the person to enhance human performance. [9]

Ergonomics = Fitting the job to the person

This study is based upon ergonomic risk contributing to musculoskeletal injuries amongst Pathology Laboratory Technicians. A Pathology Laboratory Technician is a skilled individual trained to carry out laboratory tests and to handle the laboratory equipments. In order to diagnose and treat patients, laboratory tests are carried out in various fields such as, Hematology, Biochemistry, Microbiology, Immunology, Histopathology etc.

The job of these technicians consists of static and awkward working postures, high frequency and prolonged duration. They indulge in various tasks like handling Microscopes, Pipetting, Bio analyzer activities etc. which consists continuous Wrist bending, twisting, neck bending, thumb force when pressing plunger, pinch grips, standing for prolong time and reaching too
far from body to get objects etc. All these factors increase the risk for development of job related musculoskeletal injuries.\[9\] Technology has advanced nowadays, to include automated processes for centrifugation, chemical and biological assays processes. These advancement however, have exposed many people who work inside high-tech Laboratories to hazard they had previously not experienced, such as: Low back pain and other back problems, carpal tunnel syndrome, knee pain, heel pain, shoulder pain, tendinitis etc. Ergonomic injuries, also known as musculoskeletal disorders (MSDs) or soft tissue injuries are disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, blood vessels, or spinal discs. MSD is a class of illness that is the result of months and years of overuse of human joints and connective tissues such that they become sore and sometimes unusable.\[7\] Hence the purpose of this study is to conduct Rapid Upper Limb Assessment amongst laboratory technicians to identify the ergonomic risks for development of work related musculoskeletal problems amongst them.

**Methodology**

**Research approach:** Cross-sectional Study.

**Study setup:** Pathology Laboratories in Mumbai.

**Study of population:** Pathology Laboratory Technicians.

**Sample size:** 100.

**Study tool:** 1) Self Designed Pre Validated Questionnaire.

2) RULA employee Assessment Sheet.

**Inclusion Criteria:** Pathology laboratory technicians in Mumbai who have been working for more than a year.

**Exclusion Criteria:** Study subjects who already might having any congenital musculoskeletal or neurological malformation \\ which has not been acquired due to his job

**Duration of study:** 3 months.

**Study procedure:** in keeping with the objectives of the research to be administered amongst the subjects this was done with reference to review of literature and comprised of three parts.

**Outcome Measures:**

1) Demographic details, medical and social characteristics of the subjects were collected in the first part of the questionnaire

2) Musculoskeletal problems-prevalence, intensity, frequency, region wise distribution and Numerical rating scale (NRS) collected in the second part.

3) RULA: The posture analysis amongst Pathology Laboratory Technicians was performed using Rapid Upper Limb Assessment (RULA). The Rapid Upper Limb Assessment method was developed by Dr. Lynn McAtamney and Professor E. Nigel Coelet, ergonomist from the University of the Nottingham in England. A RULA assessment gives a quick and systematic assessment of the postural risk to a worker. Rapid Upper Limb Assessment was used to evaluate awkward postures of pathology laboratory technicians in standing and sitting position. Each subject was observed in order to select the static posture which he maintain for log period of time during the laboratory work. With help of RULA employee worksheet each subject was given score on dominant and non dominant side respectively. On the basis of subjects RULA scores, the ergonomic risk for development of musculoskeletal injuries was then estimated.\[3\]

**Interpretation of RULA Score**

- (1-2) posture is acceptable if it is not repeated for long time.
- (3-4) further investigation is needed and changes may be required.
- (5-6) further investigations and changes are required soon.
- (7) Further investigations and changes are requires immediately.

**Ethical Approval:** The study was approved by the Institutional Ethics & Research Committee at D. Y. Patil University. Written informed consent was taken from all subjects & their identification information that was collected during research has been kept strictly confidential.

3. **Observation & Data Analysis:**

Qualitative analysis of the data revealed.

This survey include study of total 100 pathology laboratory technicians, in age group of (24 to 50) years. The collected data and Rapid upper limb assessment study shows that 100% (all) the study subjects are at ergonomic risk due to static working postures during laboratory work.

**Dominance:** Study also shows that 8% of the study subjects are Left handed by dominance and rest are Right handed by dominance.

Data analysis also shows that 35 study subjects works 40-49 hours per week, 40 subjects works for 50-59 hours per week and 25 study subjects works for 60-70 hours per week.
Gender wise distribution: Out of all study subjects 75% are Females and 25% are Male.

Inference: Dominant side RULA Score: according to the study it is found that,

- 12% Study subjects have Rula score 7 thus further investigation and immediate change on static working postures is necessary.
- 58% Study subjects have Rula score 5 and 6 thus further investigation and change of static working postures is necessary.
- 30% Study subjects have Rula score 3 and 4 thus further investigation on static working posture is necessary.
- As the study also reveals that due to poor ergonomics at workplace majority of the study subjects have exposed to job related musculoskeletal problems. Following graphical representation states distribution of study subjects who have been subjected to musculoskeletal problems.

Inference: Non dominant side RULA Score: according to the study it is also found that,

- 54% Study subjects have Rula score 5 and 6 thus further investigation and change of static posture is necessary.
- 37% Study subjects have Rula score 3 and 4 thus further investigation of working posture is necessary.

Discussion

This study aimed to determine risk for development of job related musculoskeletal disorders amongst 100 pathology laboratory technicians, in age group of (24 to 50) years. The collected collection through pre-validated questionnaire and Rapid upper limb assessment study shows that all the study subjects are at ergonomic risk due to static & repetitive working postures during laboratory work. Amongst all study subjects 75% are Females and 25% are Males. Study also shows that 8% of the study subjects are Left handed by dominance and rest are Right handed by dominance. As most of the laboratories are designed as per the convenience of right handed dominant people thus, we suspect chances of getting prone to work related repetitive motion injuries are more in left handed laboratory technicians.

Study also reveals that 58% of the study subjects have Rula score 5 & 6 on dominant side which indicates further investigation and soon change in static working postures. Also 12% study subjects have Rula score 7 which indicates immediate change in static working postures. Whereas on Non-dominant side, 54% study subjects have Rula score 5 & 6 which...
indicates further investigation and soon change in static working postures and 9% of the study subjects have Rula score 7 which indicates immediate change in static working posture. Awkward working postures and long duration repetitive motions increases the force and level of exertion and they may also stress the joints and reduces blood flow. Pipetting task requires thumb force when pressing plungers, repeated hand, thumb, finger and forearm motion, wrist twisting, neck bending, standing for longer period of time. While working on microscope technicians have to repeat thousands of wrist and hand movements throughout the day. Working on microscope requires prolonged flexion of back and neck, raised or shrugged shoulders, elbow abduction, awkward wrist and hand postures. Eg. Pinch grip while working with samples, power grip while adjusting microscope lenses. All these risk factors increases stress on lumbar spine and entire body. [7]

Study also have shown that 18% subjects have to lift weights of around 5kgs during work from ground and 12% subjects has to lift weights around 6-10 kgs while work from ground. When the subjects lift weights from the ground, lifting is directly by flexing the back or twisting which also contributes to pain. When the subjects lift weight from the table or ground and when it is held at arm’s length the strain on the erect spine increases thus it causes increased lumbar lordosis from the COG which can cause back pain. Increasing the distance from the body increases the moment arm of gravitational force and thus concurrently increase the muscular stress i.e. muscle compressive force on vertebral disc.[7] Study also shows that 68 study subjects use microscope while working. 10 study subjects use microscope for 240-360min, 20 study subjects use microscope for 180min, 28 study subjects use microscope for 60-120 mins and 10 study subjects use microscope for 15-30mins respectively. While working on microscope technicians have to repeat thousands of wrist and hand movements throughout the day. Working on microscope requires prolonged flexion of back and neck, raised or shrugged shoulders, elbow abduction, awkward wrist and hand postures. Eg. Pinch grip while working with samples, power grip while adjusting microscope lenses.[7] All these risk factors increases stress on lumbar spine and entire body. (Study also shows that 26% of study subject’s uses foot rest while working on microscope and computer. Those who are not using foot rest while works are prone to getting strain on heels which has significance with prolonged plantar flexion while work.

The study revealed that the subjects did not make use of arm rest which increased the muscle activity in scapular retractors and upper trapezius. The static contraction of this structures over prolong period of time could lead to pain in neck and shoulder. This finding has also been corroborated by various high quality researches. 83% of study subjects have reported to stress on eyes due to prolonged work on microscope and computer. 84 study subjects also suffer from headache due to work. Continuous looking down on microscope and on computer screen increases stress on eyes. Study have also shown that 41% of study subjects cannot adjust screen of their computer also 22% of study subjects have also reported that they don't find laboratory lighting sufficient for their work which also could lead to increase stress on eyes while working on microscope for prolong time.

Our study showed that, 8% study subjects follows treatment for job related musculoskeletal problems. This indicates lack of awareness about job related ergonomic risk amongst study subjects those who are not taking any treatment.Study also shows that many of the laboratory technicians reported that they never heard about laboratory ergonomics and neither even received ergonomic advice before from experts. When it comes to exercising and physical recreation as a part of routine life, it is found that majority of the study subjects do not give time to exercising in their daily routine.

**Conclusion**

According to the Rapid Upper Limb Assessment, majority of the subjects were exposed to ergonomic risk factors such as (awkward postures, high frequency and static muscle work) for development of job related musculoskeletal problems. It is also concluded from the study that, majority of the study subjects are not aware about ergonomic at workplace. When it comes to exercising and physical recreation as a part of routine life, it is found that majority of the study subjects do not give time to exercising in their daily routine.

**Clinical implications:**

To decrease work related musculoskeletal disorders, Laboratory Personnel should reposition tools and bring about certain modifications at workstation so that, technicians are within close reach. For Example, Modification of bench surfaces to increase knee & foot clearance, use of footrest and adjusting arm rest to support shoulders in neutral position. They should also adjust postures, seat height, seat angles, use of arm pads, and reposition of microscope, consider use of alternative pipettes and so forth. Ergonomic advice on annual basis from field of experts to all the employees at workstation is highly recommended. In conclusion, applying ergonomic modifications and engineering control in laboratory environment can significantly reduce ergonomic hazards.

<table>
<thead>
<tr>
<th>Areas of Pain</th>
<th>Low back</th>
<th>Neck</th>
<th>Shoulder</th>
<th>Leg</th>
<th>Wrist</th>
<th>Heel</th>
<th>Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Subjects</td>
<td>53</td>
<td>39</td>
<td>28</td>
<td>28</td>
<td>21</td>
<td>14</td>
<td>4</td>
</tr>
</tbody>
</table>
Conflict of interest: To the best of my knowledge there was no conflict of interest in this study.

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