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ORIGINAL ARTICLE

Ergonomic injuries in endoscopic doctors, nurses and technicians.

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ABSTRACT… Objective: To determine the frequency of ergonomic injuries in endoscopic and non-endoscopic healthcare professionals and clinical staff. **Study Design:** Cross-sectional study. **Setting:** Department of Gastroenterology, Liaquat National Hospital, Karachi, Pakistan. **Period:** October 2024 to March 2025. **Methods:** Enrolling 120 healthcare professionals (60 endoscopic, 60 non-endoscopic). Inclusion criteria were age 25–60 years, ≥6 months of clinical service, and ≥20 work hours/week. Data on demographics, comorbidities, ergonomic injury, and work patterns were collected via structured questionnaires. Endoscopy-related variables were assessed in the endoscopic group. Chi-square test, t-test, and logistic regression were applied using IBM-SPSS, v26. **Results:** Among 120 participants, 63 (52.5%) were male. Male representation was significantly higher in endoscopic doctors (56.7%) and staff (81.3%) compared to non-endoscopic groups ($p<0.001$). Musculoskeletal injuries were more frequent in endoscopic doctors (70.0%) and staff (56.3%) than non-endoscopic counterparts ($p=0.012$), with thumb pain notably higher in endoscopic doctors (26.7% vs 10.0%, $p=0.016$). Endoscopic staff had longer procedural experience (50.0% with 6–10 years; $p=0.006$) and were more often unit-based (75.0%, $p<0.001$). Endoscopic work increased injury risk (OR 3.1 doctors, 5.6 staff), while formal training was protective (OR 0.3 doctors, 0.1 staff). **Conclusion:** The incidence of ergonomic injuries is much higher among endoscopic physicians and clinical personnel in comparison to individuals who do perform endoscopic procedures. There is a higher probability of endoscopy-related injuries occurring when the frequency of procedures is increased and the duration of procedures is prolonged.

Key words: Ergonomic Injury, Endoscopy, Musculoskeletal, Pain, Thumb.

INTRODUCTION

Endoscopy of the gastrointestinal tract (GI) is an essential component of the routine work that a gastroenterologist does every day. The fact that practicing doctors in GI endoscopy are especially susceptible to work-related musculoskeletal injuries (MSI)[1] is not unexpected when one considers the intricacy of GI endoscopy and the length of time it takes to perform an examination.[2-4] It is extremely common for GI endoscopists to have injuries to their upper extremities, including their shoulders, wrists, forearms, and thumbs, as well as their necks and backs. This is because of postures that are particular to the operation.[3-5] Endoscopy procedures are abilities that gastroenterologists acquire over the course of their careers; nevertheless, ergonomic education in endoscopy, which is intended to protect the health of the physician, is not a standard component of training.[6]

Endoscopists and auxiliary workers have been found to have a significant rate of musculoskeletal injuries, according to a number of studies.[7] The prevalence of musculoskeletal pain among gastroenterologists is estimated to range from 29-89%, according to survey-based research.[8] An injury sustained on the job can have a significant impact on the quality of care and longevity of the gastroenterologist, which can eventually make the lack of specialists even worse.[9] Making improvements to ergonomic conditions will guarantee that this limited human resource be utilized to its fullest potential. The incidence of MSI is common, and it has a strong correlation with both the number of procedures and the duration of procedures.[10]

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There has been a paradigm change in the gender distribution within the area of gastroenterology as a result of the increased number of female trainees joining the profession over the course of the past decade. With the goal of providing trainees with particular instructions, improving ergonomics, and preventing musculoskeletal injuries, it is essential to acquire an understanding of the small gender differences that exist when conducting endoscopy.[6]

There is no standardized curriculum for acquiring endoscopic methods, and the majority of endoscopists learn their abilities during their fellowship training through their faculty mentor. This results in a significant amount of variation in the degree of proficiency among trainees. As a result of this unpredictability and the lack of attention placed on ergonomics during instruction, the risk of MSI is increased. Besides, the local data on this topic serving the local health care system are also scarce. To determine the frequency of ergonomic injuries in endoscopic and non-endoscopic healthcare professionals and clinical staff. Quantifying the prevalence of ergonomic injuries and investigating the related elements that have a role in the occurrence of ergonomic injuries, knowledge about the significance of ergonomics in endoscopy can be raised, with a possibility that future injuries might be avoided.

METHODS

This cross-sectional study was conducted at the department of Gastroenterology, Liaquat National Hospital, Karachi, Pakistan, during October 2024 to March 2025. Approval from Institutional Ethical Review Committee (Ref. No. 1077-2024-LNH-ERC, dated: August 21, 2024). A sample size of 38 (19 in each group) was calculated using online OpenEPI sample size calculator, considering the frequency of ergonomic injuries among endoscopic and non-endoscopic healthcare professionals as 95.1%, and 54.8%[11], respectively, taking 95% confidence interval and 80% power of study. For the purpose of this study, 120 (60 endoscopic health care professionals and their staff, and 60 non-endoscopic healthcare professionals and clinical staff were enrolled. Inclusion criteria were healthcare professionals (including physicians, nurses, and technical staff) actively involved in direct patient care and employed in either endoscopy or non-endoscopy clinical departments of the hospital for a minimum duration of six months, aged between 25 and 60 years, working at least 20 hours per week and willing to participate by providing written informed consent. For classification purposes, endoscopic healthcare professionals were defined as those performing or assisting in endoscopic procedures at least three times per week, while non-endoscopic staff included those engaged in clinical practice without involvement in any endoscopic procedures. Exclusion criteria included a prior diagnosis of musculoskeletal, rheumatologic, or neurologic conditions predating the participant's medical training, or a history of major musculoskeletal trauma or surgery within the last 12 months. Current pregnancy, or engagement in non-clinical roles such as administrative, academic, or research-only duties without regular bedside or procedural involvement were also exclusion criteria.

Demographic information including gender, age, weight, height, and body mass index (BMI) were noted. Presence of comorbidities like hypertension, asthma, and/or diabetes were documented. Gastroenterology training (yes/no), and hand dominance (right/left) were also documented. Ergonomic injury was defined as discomfort or pain in the thumb, shoulder, hand, neck, back, leg, and wrist. The study subjects were then split evenly (60 each) between endoscopic and non-endoscopic groups. The endoscopic group, comprising endoscopic physicians and clinical staff, was given a questionnaire that inquired about gastrointestinal practice features along with duration in practice, time spent performing/assisting endoscopy, taking mini-rests after each procedure (yes/no), and working in the endoscopy unit only (yes/float to other areas). The participants in the non-endoscopic group were given a modified questionnaire that did not include any endoscopy-related features. Treatment approaches among endoscopic and non-endoscopic doctors and clinical staff were assessed. Factors associated

with musculoskeletal injuries among endoscopic and non-endoscopic doctors and clinical staff were also compared. All of the relevant data were stored on a specifically pre-designed proforma.

The statistical analysis was performed using "IBM-SPSS Statistics" version 26.0. The qualitative variables were presented as frequency and percentage. The normality of the quantitative data was checked through the Shapiro-Wilk test. For the quantitative variables, mean and standard deviation (SD). Chi-square test was utilized to compare categorical data, whereas student's t-test was utilized to analyze the differences in weight, height, and BMI that existed between the groups. Logistic regression analysis was conducted, and odds ratio (OR) with 95% confidence interval (CI) were calculated taking $p<0.05$ as significant for all inferential statistics.

RESULTS

In a total of 120 participants, 63 (52.5%) were males, and 57 (47.5%) females. Male participants were significantly more prevalent among endoscopic doctors (56.7%) and staff (81.3%) compared to their non-endoscopic counterparts (10.0% and 60.7%, respectively ($p<0.001$). Participants aged <35 years were more common among non-endoscopic doctors (100%) than endoscopic doctors (63.3%), while the reverse was seen among clinical staff ($p<0.001$). BMI values were similar across groups ($p=0.266$), and comorbidities such as hypertension, asthma, and diabetes showed no significant group differences. Musculoskeletal injuries were significantly more frequent in endoscopic doctors (70.0%) and staff (56.3%) than in non-endoscopic doctors (43.3%) and staff (28.6%; $p=0.012$). Thumb pain was significantly higher in endoscopic groups, especially doctors (26.7% vs 10.0% in non-endoscopic doctors; $p=0.016$) (Table-I).

A significantly greater proportion of endoscopic staff had more years of endoscopy-related experience, with 50.0% having 6–10 years compared to only 20.0% of doctors ($p=0.006$). Most endoscopic staff (75.0%) worked exclusively in endoscopy units, whereas doctors frequently rotated to other clinical areas ($p<0.001$) (Table-II).

Regarding treatment for ergonomic injuries, oral medications and physiotherapy were the most reported interventions among both doctors and clinical staff. No significant difference in treatment approach was observed across groups (Table-III).

Multivariable analysis identified endoscopic work as a significant predictor of musculoskeletal injury for both doctors (OR 3.1, 95% CI: 1.1–8.8; $p=0.040$) and clinical staff (OR 5.6, 95% CI: 1.8–17.5; $p=0.003$). Formal training was protective, significantly reducing the odds of injury in doctors (OR 0.3, 95% CI: 0.1–0.9; $p=0.040$) and staff (OR 0.1, 95% CI: 0.1–0.3; $p<0.001$). Other factors, including gender, age, BMI, and hand dominance, were not significantly associated with injury risk (Table-IV).

DISCUSSION

The current research revealed that 70.0%) endoscopic doctors and 18 (56.3%) clinical staff had MSI, in comparison with 13 (43.3%) non-endoscopic doctors and 8 (28.6%) non-endoscopic clinical participants ($p=0.012$) involved in endoscopy. In another study in the same study setting, the total prevalence of musculoskeletal injuries among endoscopic doctors who participated in the study was found to be 95.1% versus 54.8% in non-endoscopic doctors[11], which seems comparable with the present findings. The literature reports the prevalence of pain among endoscopists ranging between from 29-89 percent.[8] These findings were corroborated by a different research (9) that acknowledged the presence of such pain and damage in 75% of the people who participated in the current investigation. Morais et al in a nationwide european study reported that 69.6% endoscopists had at least 1 musculoskeletal injury.[12] Interesetingly, a study from Japan revealed that 43% of endoscopists experienced musculoskeletal pain, in comparison to 43% non-endoscopists ($p=0.755$).[13] The same study also pointed out some modifications in endoscopy practice that may help in prevention of related musculoskeletal pain and injuries.[13]

Variables		Doctors		Clinical Staff		P-Value
		Endoscopic (n=30)	Non-endoscopic (n=30	Endoscopic (n=32)	Non-endoscopic (n=28)	
Gender	Male	17 (56.7%)	3 (10.0%)	26 (81.3%)	17 (60.7%)	<0.001
	Female	13 (43.3%)	27 (90.0%)	6 (18.7%)	11 (39.3%)	
Age groups (years)	<35 years	19 (63.3%)	30 (100%)	15 (46.9%)	15 (67.9%)	<0.001
	≥35 years	11 (36.7%)	-	17 (53.1%)	13 (32.1%)	
BMI (kg/m^2) Mean±SD		24.3±2.4	23.1±3.6	24.6±4.2	24.7±3.7	0.266
Comorbidity	Hypertension	3 (10.0%)	2 (6.7%)	3 (10.0%)	4 (13.3%)	0.974
	Asthma	3 (10.0%)	1 (3.3%)	-	-	0.108
	Diabetes	1 (3.3%)	-	2 (6.7%)	1 (3.3%)	0.746
Formal training	Yes	30 (100%)	-	30 (93.8%)	-	<0.001
	No	-	30 (100%)	2 (6.2%)	28 (100%)	
Hand dominance	Right	29 (96.7%)	26 (86.7%)	27 (84.4%)	25 (89.3%)	0.427
	Left	1 (3.3%)	4 (13.3%)	5 (15.6%)	3 (10.7%)	
Musculoskeletal injury		21 (70.0%)	13 (43.3%)	18 (56.3%)	8 (28.6%)	0.012
Pain	Hand pain	7 (23.3%)	5 (16.7%)	6 (18.8%)	1 (3.6)	0.164
	Wrist pain	8 (26.7%)	4 (13.3%)	6 (18.8%)	3 (10.7%)	0.386
	Thumb pain	8 (26.7%)	3 (10.0%)	4 (12.5%)	-	0.016
	Hand numbness	5 (16.7%)	2 (6.7%)	2 (6.3%)	-	0.123
	Shoulder pain	9 (30.0%)	9 (30.0%)	11 (34.4%)	4 (14.3)	0.334

Table-I. Comparison of descriptive features of participants among endoscopic and non-endoscopic doctors and clinical staff (N=120)

Endoscopic Features		Doctors (n=30)	Clinical Staff (n=32)	P-Value
Procedure type	Gastroscopy + colonoscopy	15 (50.0%)	17 (53.1%)	0.719
	Gastroscopy + colonoscopy + ERCP	11 (36.7%)	9 (28.1%)	
	Gastroscopy + colonoscopy + ERCP + EUS	4 (13.3%)	6 (18.8%)	
Time spent performing/ assisting endoscopy	0-5 years	23 (76.7%)	12 (37.5%)	0.006
	6-10 years	6 (20.0%)	16 (50.0%)	
	11-15 years	1 (3.3%)	4 (12.5%)	
Cumulative duration in practice	0-5 years	15 (50.0%)	8 (25.0%)	0.124
	6-10 years	6 (20.0%)	9 (28.1%)	
	11-15 years	9 (30.0%)	15 (46.9%)	
Mini-Rest after each procedure	Yes	27 (90.0%)	26 (81.3%)	0.475
	No	3 (10.0%)	6 (18.7%)	
Worked in endoscopy unit only	Yes	8 (26.7%)	24 (75.0%)	<0.001
	Float to other areas	22 (73.3%)	8 (25.0%)	

Table-II. Comparison of endoscopic features among endoscopic doctors and clinical staff

Treatment	Endoscopic Doctors (n=30)	Non-endoscopic Doctors (n=30)	Endoscopic Clinical Staff (n=32)	Non-endoscopic Clinical Staff (n=28)	P-Value
Oral medications	4 (16.0%)	4 (16.0%)	6 (18.8%)	2 (7.1%)	0.774
Physiotherapy	4 (16.0%)	2 (8.0%)	6 (18.8%)	-	0.298
Local applications	3 (10.0%)	4 (16.0%)	2 (6.3%)	1 (3.6%)	0.542

Table-III. Treatment approach among endoscopic and non-endoscopic doctors and clinical staff (N=120)

Factors		Doctors		Clinical Staff	
		Odds Ratio (95% CI)	P-Value	Odds Ratio (95% CI)	P-Value
Gender	Male	0.6 (0.2-1.8)	0.359	1.5 (0.4-5.1)	0.431
	Female	Reference category		Reference category	
Age groups (years)	<35 years	2.4 (0.6-9.9)	0.243	0.4 (0.2-1.2)	0.121
	≥35 years	Reference category		Reference category	
BMI (kg/m^2) Mean±SD		0.9 (0.8-1.0)	0.199	1.1 (0.9-1.2)	0.438
Formally trained	Yes	0.3 (0.1-0.9)	0.040	0.1 (0.1-0.3)	<0.001
	No	Reference category		Reference category	
Dominant hand	Right	2.8 (0.3-13.5)	0.440	1.3 (0.3-6.1)	0.721
	Left	Reference category		Reference category	
Endoscopic	Yes	3.1 (1.1-8.8)	0.040	5.6 (1.8-17.5)	0.003
	No	Reference category		Reference category	

Table-IV. Factors associated with musculoskeletal injuries among endoscopic and non-endoscopic doctors and clinical staff

Han et al.[14], stated shoulders and back as the most common cite for 42% and 38% of pain or discomfort. Villa et al.[3], indicated that the right wrist and left thumb were the most afflicted at 53% and 48% cases, respectively. These data seem largely inconsistent the present study also stated musculoskeletal discomfort showing variation in endoscopists experiencing pain in the back, leg, hand, and wrist, whereas non-endoscopists frequently reported experiencing pain in the thumb, shoulder, and neck. Ridtitid et al.[15], determined the incidence of musculoskeletal injuries among endoscopists, and revealed that the most common type of pain experienced by endoscopists was upper back pain, followed by pain in the thumb, low back, and hand.

A study from USA documented that musculoskeletal injuries affected up to 20% of GI fellows, while females were more likely to have injuries. These studies are somewhat similar to what was reported in this study where female gender seemed to influence the prevalence of ergonomic injuries. These finding raises the possibility that gender does play a role in influencing the MSI. Some other researchers have shown that no gender-related differences existed regarding MSI.[7] Some researchers have found that the number of years in practice and the volume of procedures performed are both risk factors for injuries.[17,18] In the process of performing an endoscopy, some of the most crucial aspects are repeated motions, overuse of muscles, and extended standing, as all of these factors are important components of the procedure.[19] The most significant elements that can have an effect include prolonged, recurrent use of integral sections of the body during endoscopic operations, as well as excessive use of these areas. During a colonoscopy, some of the endoscope-associated manoeuvres that might result in endoscopy-specific injuries include adjusting tip angulation controls and torqueing. These injuries are particularly known as colonoscopist's thumb or de Quervain's tenosynovitis.[20] In the field of endoscopy, it is anticipated that the major causes

of overuse injuries related to repeated motions are procedures that are performed often, in high volumes, and for extended periods of time each week.[15]

There are some limitations to this study. Relatively modest sample size, and a single center study design limits the generalizability of the present findings. Self-reported data could introduce recall and reporting bias, particularly regarding musculoskeletal symptoms. potential confounders such as workload intensity, posture during procedures, and non-occupational physical activity were not assessed.

CONCLUSION

The incidence of ergonomic injuries is much higher among endoscopic physicians and clinical personnel in comparison to individuals who do perform endoscopic procedures. There is a higher probability of endoscopy-related injuries occurring when the frequency of procedures is increased and the duration of procedures is prolonged.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Aisha Saleem:** Data collection, drafting, responsible for data's integrity, approved for publication.
2	**Lubna Kamani:** Conception, design, critical revision, proof reading, approved for publication.