

PREVALENCE AND RISK FACTORS FOR MUSCULOSKELETAL COMPLAINTS AMONG ENDOSCOPISTS

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Abstract

Introduction: Gastroenterologists spend considerable time performing endoscopic procedures that necessitate repetitive motions. The number of endoscopic procedures performed by gastroenterologists has increased significantly in the past 20 years. Among physicians, endoscopists faces increased risk for work-related musculoskeletal disorders (WMSDs) compared to other physicians who are not performing this procedure. **Aim of work:** To determine the prevalence of musculoskeletal disorders (MSDs) symptoms among the endoscopists and their assistants who are working in Menoufia University, Teaching and General hospitals in Menoufia governorate - Egypt and to determine their risk factors. Also, to study the effects of MSDs on their work and daily activities. **Materials and methods:** A comparative cross-sectional study was done using a predesigned questionnaire to assess the musculoskeletal disorders among gastrointestinal endoscopists who were compared with other physicians not performing interventional procedures. **Results:** The present study showed that musculoskeletal complaints were more evident among endoscopists, e.g., neck, shoulder, wrist, and non-dominant thumb pain showed a statistically significant difference when compared to the control group (26.1%, 68.7%, 30.4%, 52.2%, 56.5%), respectively, compared to (15%, 17%, 19%, 10%, and 0%) respectively ($p < 0.001$). Endoscopists reported that their pain interferes with daily life activities and cause sleep disorders. Endoscopists who reported pain at different body sites present significant association after adjustment with age (OR=4.95; 95% CI: 2.12-11.56) working duration > 10 years (OR=5.82; 95% CI: 2.37-14.28), number of operations >3 /day (OR=4.53;95% CI: 2.03-10.09), duration of single operation > half an hour (OR=3.80; 95% CI: 1.60-9.04) and the single hand intubation technique (OR=8.0;95% CI: 3.10-20.62). **Conclusion:** The performance

of endoscopy puts the physicians at risk of biomechanical injury. Education of the endoscopists toward correct ergonomic practices, the spacing between procedures is required to improve the endoscopists' quality of life.

Keywords: Musculoskeletal disorders , Endoscopists, Ergonomics, and Shoulder pain.

Introduction

The study of ergonomic originates from the Greek words ergo (work) and nomos (law), (Singla et al., 2018). It is the study of the cognitive and physical demands of a task concerning individual's capacity (Amandeep et al., 2009).

Musculoskeletal disorders (MSDs) account for about 70 million physician office visits in the United States annually. The Institute of Medicine estimations of the economic load of work-related musculoskeletal disorders (WMSDs) – as calculated by compensation costs, lost wages, and lost productivity – are between 45 billion and 54 billion dollars annually (CDC, 2016). Besides economic loss, these disorders also lead to decreased quality of life. Those working in healthcare facilities are especially prone to WMSDs (El Badry et al., 2018). Among physicians, endoscopists are at increased risk for WMSDs compared to other physicians who are not performing this procedure, as 37 % to 89 % of endoscopists reporting musculoskeletal injuries

(Hansel et al., 2009 and Villa et al., 2019)

Gastroenterologists, spend considerable time performing endoscopic procedures that necessitate repetitive motions as flexion and extension of the wrist and fingers and torsional movements of the right hand, which may predispose to overuse injuries. The volume of endoscopic procedures performed by gastroenterologists has increased significantly in the past twenty years (Singla et al., 2018).

In a survey of 684 American Society for Gastrointestinal Endoscopy (ASGE) members examining injury prevalence and risk factors, 35.3% experienced injuries supposed to be related to endoscopy (Riditid et al., 2015). Risk factors included higher procedure rate more than 20 cases per week, prolonged duration of performing endoscopy more than 16 hours per week, and the years spent performing endoscopy leads to overuse injury from repetitive movements (Liberian, 2005 and Morais et al., 2020). Other reported

risk factors are unfitting position during performing endoscopy and endoscopy-specific maneuvers like torquing during colonoscopy and usage of control dials (Byun et al., 2008 , Shergill et al. 2009 and Khan et al., 2020)

Up to our knowledge, few researches concerning ergonomic disorders among endoscopists and gastroenterologists have been issued in Menoufia Governorate.

The study of the incidence and the prevalence of musculoskeletal disorders among health care providers may help in adequate prevention of work-related diseases and, consequently, provide a safer and healthier environment for them. So, we decided to enter this field and try to highlight such health risks to this job category.

Aim of work

To determine the prevalence of MSDs symptoms among the endoscopists and their assistants who are working in Menoufia University, Teaching and General hospitals in Menoufia governorate - Egypt and to determine their risk factors. Also, to study the effects of MSDs on their work and daily activities.

Materials and methods

Study design: It is a comparative cross-sectional study.

Place and duration of study: This study was conducted from the beginning of October 2019 to the end of February 2020, at the University, Teaching and General Hospitals, Menoufia governorate, Egypt.

Study Sample: The study sample was all the attendants of the Hepatology, Gastroenterology, and Infectious Disease Association Scientific Meeting (HGIDA), performed at Shebin El Kom, Menoufia, in November 2019 (150 endoscopists). One hundred and fifteen out of 150 (response rate of 76.7%) physicians had responded to the questionnaire as a target research group. Another 170 questionnaires were distributed among the Pediatric and Internal Medicine physicians at Shebin Elkom Teaching Hospitals and Menoufia University Hospitals (other physicians not performing interventional procedures were taken as a control group), where 150 physicians (response rate 88.2%) responded to the questionnaire.

Study Methods: The research group developed and validated a well designed **self-administered question-**

naire, quoted with referencing to different standardized Musculoskeletal assessment (e.g. Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms, questionnaire about troubles with the locomotive organs) (Kuorinka et al., 1987).

Consent

An informed consent was provided by the participants who participated in the study and confidentiality was maintained.

Ethical approval

The Menoufia Faculty of Medicine Committee for Medical Research Ethics

revised and formally approved the study before it was initiated.

Data management

Data were collected, tabulated, and statistically analyzed using the statistical package (SPSS), version 21. The data were presented as descriptive statistics, and the (chi-square) test was done to study the relation between qualitative variables. A stepwise logistic regression analysis was done to determine the adjusted odds ratio (OR) and 95% confidence interval (CI) for the different risk factors and MSDs. P-value < 0.05 was considered statistically significant.

Results

Table 1: Comparison between endoscopists and the control group regarding sociodemographic characteristics.

	Endoscopist No:115		Control No:150		Test of significance t-test	p-value
Age (Mean ± SD)	42.1±7.8		43.2±6.2		1.28	0.20
Duration of work/years	10.8±3.6		11.3±3.9		1.07	0.29
Work hours/day	7.2±1.8		7.1±2.3		0.38	0.7
	No	%	No	%	Chi-squared test	
Dominant hand during work						
Right						
Left	115 0	100 0	145 5	96.7 3.3	2.31	0.13

Table 1 showed that there was no statistically significant difference between endoscopist and the control group as regards the age, working years, working hours per day, and dominant hand during work.

Table 2: Comparison between the site of pain among endoscopists and control groups.

	Endoscopist No:115		Control No:150		Test of significance	p-value
	No	%	No	%	Chi squared test	
Neck pain						
Present	30	26.1	15	10	10.84	<0.001**
Absent	85	73.9	135	90		
Shoulder pain						
Present	36	68.7	17	11.3	16.23	<0.001**
Absent	79	31.3	133	88.7		
Elbow pain						
Present	35	30.4	19	12.7	12.67	<0.001**
Absent	80	69.6	131	87.3		
Wrist pain						
Present	60	52.2	10	6.7	69.35	<0.001**
Absent	55	47.8	140	93.3		
Non-Dominant Thumb pain #						
Present	65	56.5	0	0	109.30	<0.001**
Absent	50	43.5	150	100		
Back pain						
Present	40	34.8	45	30	0.68	0.49
Absent	75	65.2	105	70		

** : Highly statistically significant

: Non dominant thumb means that thumb pain is reported at the left thumb for those who use their right hand , as they use the left thumb to turn both control dials (wheels) on the colonoscopic head and vice versa.

Table (2) showed a highly statistically significant difference of neck, shoulder, wrist, and non-dominant thumb pain among the endoscopist compared to the control group ($p < 0.001$).

Table 3: Description of the effect of pain on work and daily activities among the affected endoscopists.

	Endoscopists reported pain at any site No=70	
	No	%
Pain during work		
Decrease	0	0
No change	33	47.1
Increase	37	52.9
Pain after work		
Decrease	27	38.6
No change	33	47.1
Increase	10	14.3
How much does it interfere with work?		
No interference	32	45.7
Some interference	25	35.7
Had to take time off work due to pain	13	18.6
How much does it interfere with life outside work?		
No interference	10	14.3
Some interference	46	65.7
Had to stop enjoying activity due to pain	14	20.0
How much does it interfere with sleep?		
No interference	46	65.7
Some interference	15	21.4
It affects everyday night sleep	9	12.9

Table 3 showed that 52.9% of endoscopists reported a general increase in pain during work, while 47.1% experienced no change in body pain after work. Also, 45.7% declared that pain interferes with their work activities in addition to 65.7% of the studied group, reported that pain presents some interference with their life outside work. In the context, 21.4% affirmed some sleep disturbance, and 65.7% stated that they have no sleeping problems associated, and 12.9% have every night sleeping interruption.

Table 4: Risk factors of pain among endoscopists.

Risk factors	Positive cases No=70		Negative cases No=45		Chi-square test	p-value	Odds ratio (CI at 95%)
	No	%	No	%			
Age/years:							
>40	41	58.6	10	22.2	14.66	<0.001**	4.95 (2.12-11.56)
<40	29	41.4	35	77.8			
Clinical practice/years:							
>10	39	55.7	8	17.8	16.31	<0.001**	5.82 (2.37-14.28)
<10	31	44.3	37	82.2			
Number of operations/ days:							
>3	50	71.4	16	35.6	14.41	<0.001**	4.53 (2.03-10.09)
<3	20	28.6	29	64.4			
Duration of single operation:							
>Half an hour	49	70.0	12	26.7	9.48	0.002*	3.80 (1.60-9.04)
<Half an hour	21	30.0	33	73.3			
Intubation technique in colonoscopy							
Single-handed	60	85.7	15	33.3	21.0	<0.001**	8.0 (3.10-20.62)
Assisted hand	10	14.3	20	66.7			

*: Statistically significant

**: Highly statistically significant

Table 4 showed that endoscopist who reported pain at different body sites present significant association after adjustment with age (OR=4.95; 95% CI: 2.12-11.56) working duration > 10 years (OR=5.82; 95% CI: 2.37-14.28), number of operations >3 /day (OR=4.53;95% CI: 2.03-10.09), duration of single operation: > half an hour (OR=3.80; 95% CI: 1.60-9.04) and the single hand intubation technique (OR=8.0;95% CI: 3.10-20.62).

Discussion

Musculoskeletal complaints are widespread among gastroenterologists and colonoscopists. They are at risk for overuse injuries, such as carpal tunnel syndrome (CTS), De Quervain's tenosynovitis, and lateral epicondylitis due to repetition and prolonged awkward postures associated with endoscopy. (Emmanuel, 2018).

So, the need for ergonomic evaluation is urgent, considering studies highlighting overuse injuries in endoscopists. Survey-based studies have assessed the prevalence of musculoskeletal symptoms ranging from 37% to 89% (Siau and Anderson, 2019).

The present work highlights that both study groups (endoscopists and controls) are nearly matched regarding their mean age (42.1 ± 7.8 years) and (43.2 ± 6.2 years), respectively. Both groups are of the male sex as there is a rarity of Egyptian female endoscopists. Also, the mean work duration of both groups was (10.8 ± 3.6) years among endoscopist and (11.3 ± 3.9 years) among control groups, in addition to working hours/day (7.2 ± 1.8) among endoscopist and control groups (7.1 ± 2.3). So, both groups are matched regarding their general characteristics.

The current study showed that the most prevalent type of musculoskeletal pain affecting endoscopists was shoulder pain (68.7%), followed by the non-dominant thumb pain (56.5%) then wrist pain (52.2%) and finally elbow pain (30.4%) (Table 2). All previously mentioned pain sites present a statistically significantly higher prevalence among endoscopists compared to control groups ($p < 0.001$). Such findings can be explained by the needed firm grasping and pressure during the endoscopy procedures. This is in concordance with the study done by Emmanuel et al. 2018 on occupation-associated health hazards for the gastroenterologist/endoscopists and stated that reported injuries of the hands, fingers, neck, and back are common manifestations while performing the colonoscopy. The colonoscopists are more prone to the development of MSDs than the other endoscopists, due to longer mean procedure time and the vigorous use of muscle power to manipulate the scope. Also, Liberman et al., 2005 on their study on injuries sustained by colorectal surgeons performing colonoscopy detected the same results.

Cappell 2006 described the condition of «colonoscopist's thumb»

a result of repetitive abduction and extension of the left thumb in the manipulation of the colonoscope dials. The muscles of the right forearm are also highly exposed to exhaustion in single-handed operators in colonoscopy due to the induction and maintenance of torque movements.

Another injury resulting from overuse is the «biliary endoscopist's knuckle,» from the repeated advancing of biliary instruments through often narrow strictures and the tight grip used when handling the pusher catheters (Siegel et al., 1994 and Emmanuel et al., 2018). Such results cope well with the published data, which focused on the prevalence of musculoskeletal injuries and assessing the role of ergonomics among gastroenterologists (Harvin G, 2014 and Singla et al., 2018). Similarly, many other studies reported that the prevalence of musculoskeletal pain or injuries ranges from 29% (Keate et al., 2006) up to 89% (Byun et al., 2008). Other studies reported such prevalence to be 39% by (Lieberman et al, 2005), 74% by (Hansel et al., 2009) and 43% (Kuwabara et al., 2011)

Other frequent injuries or pain reported in other studies includes shoulder pain (9% to 32%), hand pain

(9% to 17%), neck pain (9% to 28%), hand numbness (12%), low back pain (6% to 27%), elbow pain (8% to 15%) and thumb pain (5% to 19%) (Harvin, 2014).

The present study demonstrated that 34.8% of endoscopists were complaining of low back pain, although it showed no statistically significant difference when compared to the control group (Table 2). A finding that can be explained by the fact that both studied groups are physicians, a professional category that is well-known for developing occupational musculoskeletal disorders due to several risk factors including-and not limited to- prolonged static postures, repetitive movements, poor positioning, high workload and prolonged working hours. Our explanation could be supported by the study results of Derek et al., 2006 in their study on musculoskeletal complaints and psychosocial risk factors among physicians in mainland, China, and concluded that MSDs affect a wide variety of workers in the health care industry and appear to be a predominantly important problem for physicians. This conclusion depended on studying a total of 361 doctors who reported MSDs at anybody region during

the last 12 months, and the complaints were most commonly reported at the lower back (43.7%).

Carpell 2010 in his study on injury to endoscopic personnel from tripping over exposed cords, wires, and tubing in the endoscopy suite: a preventable cause of potentially severe workplace injury has highlighted accidents that resulted in musculoskeletal injuries, including slip and fall on wet floors and fall over exposed wires, cords, and oxygen tubing.

As noticed, our study's results are in the context of many other research results targeting healthcare providers of different job categories in different countries worldwide.

The current work displays the effect of occupational pain at different body sites on the affected person's work as well as his general daily life outside his workplace. More than half of the endoscopist (52.9%) reported pain during work and (14.3%) reported that pain even increases after work time, or pain remains unchanged (47.1%) a problem that positively affects the endoscopist's performance and may lead to sick leave as reported by (18.6%) of endoscopist in addition to a prevalence of (35.7%) of them reporting that pain represents some

interference with their work. Also, such pain may have disturbed their healthy daily life, a conclusion that has been reported by (20.0%), while (65.7%) stated that such pain stands for some interference with their daily lives (Table 3). These results were in agreement with that of Rambabu and Suneetha, 2014 during their study on the prevalence of work-related musculoskeletal disorders among physicians, surgeons, and dentists: A comparative study ; and they found a significant number of doctors, i.e., six physicians, 29 surgeons, and 36 dentists, suffered from absenteeism from the job, as musculoskeletal comorbidity was high. A significant proportion of the studied subjects reported chronic complaints, medical care seeking and absenteeism from work explained by the fact that repeated and prolonged static postures are assumed to start a sequence of events that could account for pain, injuries, or career-termination problems. Also, Bolbol et al., 2017, during their study on work-related musculoskeletal disorders: an ergonomic interventional program among Al Ahrar hospital intensive care units' nurses, found that low back pain was the most incriminated in reduced work and leisure time activities among ICU nurses.

Additionally, Cristiana and Eunice (2012) on a case study in University of Ilorin and Obafemi Awolowo University Teaching Hospital detected that low back pain was the most common cause of restricting and limiting daily activities, taking many days off, and thoughts of career shifting. Consistently in agreement with our study results, Adhikhari and Dhakal (2014) clarified that due to low back pain, most of the nurses were unable to perform their job effectively, became less productive, and had a restriction in their work duties. Capell, 2010 and 2011 deduced that, on average, endoscopic-related musculoskeletal injuries result in 6 lost working days and nine restricted workdays. So, the need for ensuring proper ergonomic practice impacts endoscopic personnel, patients, and hospital systems.

Logically, it was expected that MSDs affecting our study group interfered with their sleep, which already reported during the study as (12.9%) (Table 3) confirmed that pain affects them during sleep every night, a finding that coincides with the findings of Vinstrup et al., 2018 in their study on the association of stress and musculoskeletal pain with poor

sleep: a cross-sectional study among 3,600 hospital workers; who detected that stress and pain are associated with increased risk of poor sleep in a population of 3,593 Danish hospital workers, and both stress and pain influence the risk of poor sleep in a dose-response manner.

As regards the different risk factors for developing work-related musculoskeletal pain among endoscopist; the present study compared some risk factors among those who reported suffering of work-related pain versus those who did not report such pain within the endoscopist group where the prevalence of pain increased with age group >40 years (OR=4.95; 95% CI: 2.12-11.56) and those with work duration more than ten years (OR=5.82; 95% CI: 2.37-14.28) (Table 4). This may be clarified by the additional effect of long working duration and age-related skeletal problems.

Besides, the work volume looks to present a risk factor in developing work-related musculoskeletal pain, as 55.7% of endoscopists complained of pain related to their work where they reported performing more than three endoscopes /day, the same observation was reported by (Emmanuel et al., 2018), who found in their study that

Gastroenterologists spend 43% of their time performing endoscopic procedures and perform an average of 12 endoscopies and 22 colonoscopies per week. Also, to our previous findings, a duration of more than half an hour/operation (OR=3.80; 95% CI: 1.60-9.04) proved to be a significant risk factor in developing musculoskeletal disorders among endoscopist. Also, in the current study, using single hand intubation technique during endoscopy procedures reported to be associated with more prevalence of occupational pain in the professional category (endoscopist) (OR=8.0;95% CI: 3.10-20.62) (Table 4) a finding going with that of (Korman et al., 2009), who concluded that studies measuring forces during colonoscopy had demonstrated high peak forces, especially during colonoscope insertion, which may reach levels associated with an increased risk of injury to the thumb and wrist. Also, MSDs increased significantly in endoscopists who undergo colonoscopic interventions like polypectomy, endoscopic mucosal resection (EMR), stricture dilatation, and endoscopic stenting. This can be explained by long procedure time and the handcraft which needs sustained muscle strain all over the time of intervention. Our study's findings correlate with other published data as the studies of (Riditid

et al., 2015 and Singla et al., 2018) stated that several factors influence endoscopy-related musculoskeletal pain. The most critical factors are overuse and repetitive movements along with prolonged standing, all of which are integral parts of performing endoscopy. Previous studies have shown that performing endoscopy for more than sixteen hours per week or twenty cases increases the risk of musculoskeletal injuries. ASGE 2010 declared that pain in the thumb, hands, neck, and back was most commonly stated, and, not surprisingly, the risk of injury seems to be related to procedure volume.

Conclusion:From the above findings, we can conclude that the performance of endoscopy places its practitioners at risk of biomechanical injury. So, we recommend endoscopists to optimize their work environment. Education of the endoscopists toward correct ergonomic practices, the spacing between procedures is required to improve the endoscopists' quality of life.

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Conflict of interest

No conflict of interest has been declared

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