

PREVALENCE AND RISK FACTORS FOR ENDOSCOPY RELATED MUSCULOSKELETAL INJURIES AMONG GASTROENTEROLOGISTS

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ABSTRACT

Significance: Musculoskeletal injuries are common among GI endoscopists. Endoscopists are presumably at risk for overuse syndromes because of the repetitive movements and potentially awkward posture associated with endoscopy. This study aims to define the prevalence of endoscopy-related musculoskeletal injuries among gastroenterologists and to determine the types of endoscopy-related musculoskeletal injuries in the current practice. This study also aims to enhance awareness of ergonomic principles and prevent endoscopic-related injuries.

Methodology: A modified version of survey questionnaire used based on the 25-question, self-administered electronic survey form developed by American Society for Gastrointestinal Endoscopy (ASGE) Web-based Survey was conducted among gastroenterologists practicing in different hospitals in the Philippines.

Results: The survey was completed by 204 endoscopists. Factors associated with a higher rate of endoscopy-related injury included higher procedure volume (11-20 cases/week; n=90, 44%), and greater number of hours per week spent performing endoscopy (11-20 hours/week; n=91, 44.6%). The most common musculoskeletal injuries were thumb pain, shoulder pain, hand/wrist pain, and leg cramps. There is a statistically significant difference in the highlighted types of injuries when grouped according to years of practice. Endoscopists who required treatment for their musculoskeletal injuries were noted in 46 out of 204 (22.5%, p-value 0.001). And about 98 out of 204 respondents (48%) required only rest for management of musculoskeletal symptoms.

Conclusion: Ergonomics plays an important role in injury prevention for endoscopists. Raising awareness and enhancing ergonomics in endoscopy may prevent endoscopic-related injury.

Key words: survey; musculoskeletal injury; gastroenterologists; ergonomics; endoscopy

INTRODUCTION:

Gastrointestinal (GI) endoscopy remains the cornerstone of screening, investigation and treatment of several GI conditions, with an increasing number of procedures performed worldwide. However, although several studies and clinical audits have been carried out on patient safety and tolerance of GI endoscopy, there are remarkably less data on the safety and comfort of endoscopists themselves. The assessment and prevention of work-related injury to physicians who perform endoscopy is a remarkably understudied area, but an extremely important one. According to a recent American Society for Gastrointestinal Endoscopy (ASGE) survey, gastroenterologists spend 43% of their time performing endoscopy, and increased endoscopy volume is associated with an increased risk of musculoskeletal complaints.¹

SIGNIFICANCE

Musculoskeletal complaints and injuries of the upper extremity are common among endoscopists. The prevalence of musculoskeletal complaints among endoscopists ranges from 37% to 89% (Shergill et al., 2009a), and musculoskeletal injuries are more frequent among gastroenterologists compared to other non-procedure-oriented specialists². Common regions of pain are the left thumb, right wrist, neck and back among gastroenterologists which may be due to the high forces, sustained muscle loading, repetition, and awkward postures associated with endoscopy.³

Ergonomics is the study of the physical and cognitive demands of a task in relation to an individual's capacity.⁴ Ergonomics plays an important role in injury prevention for endoscopists. Raising awareness and enhancing the knowledge of ergonomics in endoscopy may prevent endoscopic-related musculoskeletal injury. Furthermore, such aspects should perhaps be addressed during endoscopy training, to ensure the development of safe and effective techniques as part of competency skills of gastroenterologists. This would improve quality of care overall, with benefits for both patients and clinicians.

OBJECTIVES

- To define the prevalence of endoscopy-related musculoskeletal injuries and their impact on clinical practice and to identify physician and practice characteristics associated with their development.
- To determine the types of endoscopy-related musculoskeletal injuries in the current practice with advanced therapeutic interventions

METHODOLOGY

A survey of musculoskeletal symptoms perceived related to endoscopy procedures, environmental factors affecting endoscopy and modification of practice and treatments for musculoskeletal injuries, using questionnaire form, to be conducted among gastroenterologists practicing in different hospitals in the Philippines. The survey form was distributed to the participants during the conventions/meetings and answered accordingly. All answers remained anonymous to minimize the potential for response bias.

The modified version of survey questionnaire used in the study was based on the 25-question, self-administered electronic survey form developed by American Society for Gastrointestinal Endoscopy (ASGE) Web-based Survey⁵. The modified survey form measured endoscopist's characteristics, workload parameters, and experience during and after participants endured an injury. Endoscopist characteristics included age, sex, hand dominance, and physical activity level. Workload parameters included number of years in practice, hours and number and/or type of endoscopies per week, and proportion of time spent performing procedures. Injury experiences included location of pain or injury, the effect of the injury on work, modifications of practice, and required treatments.

STATISTICAL ANALYSIS

Chi-square (X^2) tests will be used to assess variables including age, sex, hand dominance, physical activity level, and practice years. To identify the relationship between the categorical variables, Fisher's Exact Test was used. All significance levels will be set at $P < 0.05$.

RESULTS

A total of 204 gastroenterologists answered the modified survey on Musculoskeletal Injuries Related to Endoscopy validated from the American Society for Gastrointestinal Endoscopy.

TABLE 1: BASELINE CHARACTERISTICS

VARIABLE	FREQUENCY N= 204	PERCENT
GENDER		
Male	142	69.6
Female	62	30.4
HAND DOMINANCE		
Right	199	97.5
Left	5	2.5
<i>(p-value 0.001)</i>		
PHYSICAL ACTIVITY LEVEL		
Mild	88	43.1
Moderate	97	47.5
Very Active	19	9.3
AGE (years)		
Mean	49	
Minimum	33	
Maximum	82	
YEARS OF PRACTICE		
Mean	14	
Minimum	1	
Maximum	49	
<i>(p-value 0.024)</i>		

Out of the 204 respondents from the survey, there was predominance of male endoscopists (n=142, 69.6%) as compared with female endoscopists (n= 62, 30.4%). Majority of the endoscopists have right hand predominance (n= 199, 97.5%) versus left hand constitutes smaller population (n=5, 2.5%). Most of the endoscopists are engaged into mild and moderated activity level (n=88, 43.1% and n=97, 47.5% respectively). However, only less number of them are involved in very active in physical activities (n=19, 9.3%). Meanwhile, the mean age of endoscopists who participated in the survey were 49 years old (minimum of 33 years of age and maximum age of 82 years). The mean years of practice was 14 years, with minimum of 1 year and maximum of 49 years of practice.

TABLE 2: WORKLOAD PARAMETERS

Duration of Performing Endoscopy (years)	Frequency, N=204	Percent
1-5	21	10.3
6-10	54	26.5
11-15	61	29.9
16-20	31	15.2
21-30	31	15.2
>30	6	2.9
Endoscopic Procedures Performed (number per week)		
1-10	55	27.0
11-20	90	44.1
21-30	59	28.9
Time Spent Performing Endoscopy (hours per week)		
1-10	48	23.5
11-20	91	44.6
21-30	59	28.9
31-40	4	2.0
>50	2	1.0

Most of the endoscopists were performing endoscopic procedures for 6-10 years (n= 54, 26.5%) and 11-15 years (n=61, 29.9%). While 6 endoscopists (2.9%), were practicing for more than 30 years.

About 99 endoscopists (44.1%) performed 11-20 endoscopic procedures per week. The rest of the respondents performed 1-10 endoscopy per week (n=55, 27%) and 21-30 endoscopy per week (n=59, 28.9%).

Majority of the respondents spent time in performing endoscopic procedures at 11-20 hours/week (n=91, 44.6%). Meanwhile, about 2 endoscopists (1%) performed endoscopy for more than 50 hours a week.

TABLE 3: ENDOSCOPIC PROCEDURES PERFORMED PER WEEK

Endoscopic Procedures Performed per week	Mean	Std Dev	P-value
EGD	50.08	±12.38	0.001
Colonoscopy	43.44	±11.50	0.016
ERCP	6.00	±7.70	0.160
EUS	0.42	±3.00	0.243
Enteroscopy	0.20	±0.95	1.002

In Table 3 which showed the mean of endoscopic procedures performed per week by the respondents. The majority of the endoscopic procedures performed were esophagogastroduodenoscopy (EGD) which accounts for 50.08 ± 12.38 (mean ±SD) followed by colonoscopy which comprised of 43.44 ±11.50 of endoscopic procedures. However, sub-specialty endoscopic procedures namely, ERCP (6.00 ±7.70), endoscopic ultrasound, EUS (0.42 ± 3.00) and Enteroscopy (0.20 ± 0.95) account for the remaining procedures for which they require further training.

FIGURE 1: MUSCULOSKELETAL INJURIES PERCEIVED RELATED TO ENDOSCOPY

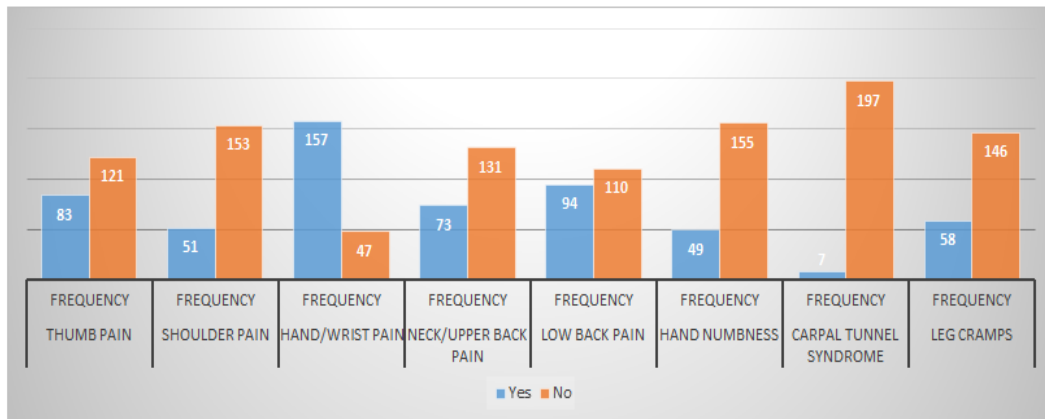


Figure 1 showed frequency of musculoskeletal injuries perceived related to endoscopy. The hand/wrist pain for which respondents answered yes (n=157) and no (n= 47) accounts for the majority of the musculoskeletal symptoms perceived related to endoscopy. This was followed by low-back pain (n=94), thumb pain (n=83), neck/upper back pain (n=73), leg cramps (n=58), shoulder pain (n=51), hand numbness (n=49) and carpal tunnel syndrome (n=7).

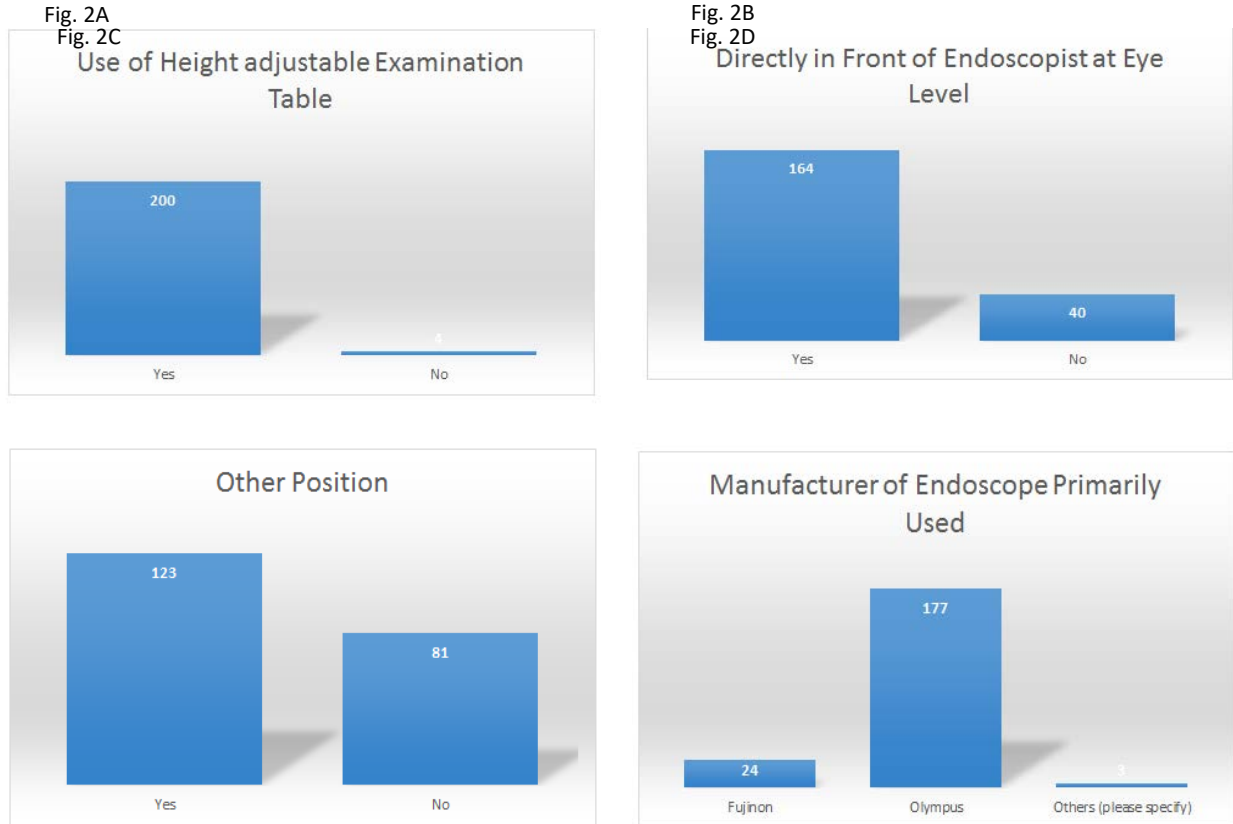
TABLE 4: INTERVENTIONS PERFORMED ON PERCEIVED MUSKULOSKELETAL INJURIES RELATED TO ENDOSCOPY

Response	Required time off from Endoscopy		Required Modifications of Practice		Required Treatment	
	Frequency N= 204	Percent	Frequency n=204	Percent	Frequency N=204	Percent
Yes	56	27.5	96	47.1	46	22.5
No	148	72.5	108	52.9	158	77.5

In Table 4, which showed the interventions performed by endoscopists on their perceived musculoskeletal injuries, about 27.5% (n=56) required time off from endoscopy procedures while 72.5% (n=148) did not required time off from procedures. Endoscopists who required modifications of practice accounts for 52.9% (n=108) and those who did not require modifications comprised of 47.1%

(n=96). And 77.5% (n=158) of the respondents did not require treatment as compared to 22.5% (n=46) endoscopist required treatment.

FIGURE 2: ENVIRONMENTAL FACTORS AFFECTING ENDOSCOPIC PROCEDURES



In Figure 2 showed environmental factors affecting the procedures. Most endoscopists (n=200, 98.4%) indicated that they used height adjustable examination tables. As for monitor position, 164 of 204 (80.5%) endoscopists replied that that monitor was directly in front of the endoscopist and at eye level. There were 123 out of 204 (60.5%) endoscopists replied that some of their monitors are positioned at the side of the endoscopist. With regard to the manufacturer of the endoscope used, 177 (87%) endoscopists used Olympus, 24 (12%) used Fujinon, and 3 (1.5%) used other brand (did not specify).

FIGURE 3: MODIFICATION OF PRACTICE AND TREATMENTS DONE FOR ENDOSCOPY-RELATED INJURIES

Fig. 3A

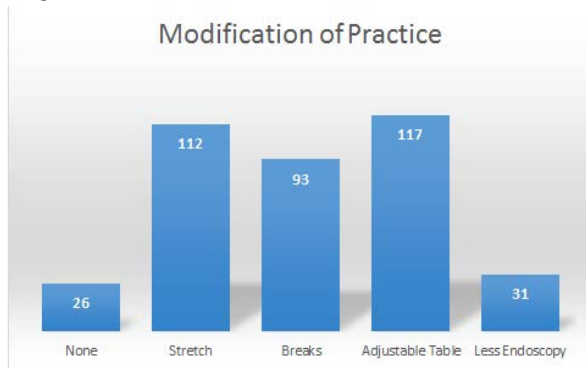
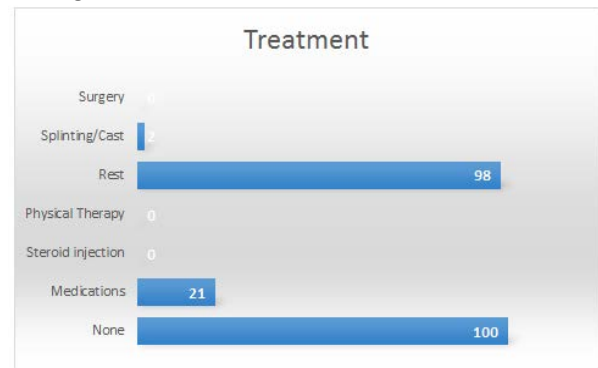


Fig. 3B



In Figure 3, only 26 (12.5%) endoscopists had no modifications made to their endoscopic practice in response to musculoskeletal injuries incurred due to performing endoscopic procedures. The most common practice modifications endorsed are shown in Figure 3A. These modifications were stretching exercises ($n = 112$, 55%), taking breaks ($n = 93$, 46%), adjustable table ($n=117$, 57%) and less endoscopy ($n = 31$, 15%). There were only 21 (10.5%) endoscopists required medications for pain relief (e.g. oral form of analgesics), and 2 (1%) endoscopists underwent splinting/cast for temporary immobilization of injured extremity. About 100 out of 204 (49.5%) endoscopists did not require any treatment and 98 out of 204 respondents (48%) required only rest for management of musculoskeletal symptoms.

TABLE 5: PREVALENCE OF MUSKULOSKELETAL INJURIES TO THE YEARS OF PRACTICE

Type of Injury	Yes/No	Years of Practice		Total	P-value
		<i>Less than 20</i>	<i>Greater/Equal to 20</i>		
Thumb Pain	Yes	58	25	83	0.014
	No	102	19	121	
Shoulder Pain	Yes	35	16	51	0.049
	No	125	28	153	
Hand/Wrist Pain	Yes	129	28	157	0.018
	No	31	16	47	
Neck/Upper Back Pain	Yes	54	19	73	0.248
	No	106	25	131	
Lower Back Pain	Yes	74	20	94	0.925
	No	86	24	110	
Hand Numbness	Yes	43	6	49	0.069
	No	117	38	155	
Carpal Tunnel Syndrome	Yes	4	3	7	0.173
	No	156	41	197	
Leg Cramps	Yes	52	6	58	0.014
	No	108	38	146	
Required time off from Endoscopy	Yes	41	15	56	0.265
	No	119	29	148	
Required Modifications of Practice	Yes	73	23	96	0.434
	No	87	21	108	
Required Treatment	Yes	21	25	46	<.0001
	No	139	19	158	

In table 5 showed the prevalent musculoskeletal injuries incurred during the years of practice. The most common musculoskeletal injuries among the endoscopists included in the study were thumb pain, shoulder pain, hand/wrist pain, and leg cramps. There is a statistically significant difference in the highlighted types of injuries when grouped according to years of service (less than 20

years of practice and those more than 20 years in practice). Thumb pain was evident in 58 out of 160 (36.25%) vs 25 out of 44 (56.82%) of the endoscopists. Shoulder pain is seen in 35 out of 160 (21.88%) vs 16 out of 44 (36.36%) of the respondents. The hand/wrist pain is present in 129 out of 160 (80.63%) vs 28 out of 44 (63.64%) endoscopists. And lastly, leg cramps is seen in 52 out of 160 (32.5%) vs 6 out of 44 (13.64%) endoscopists. Endoscopists who required treatment for their musculoskeletal injuries were noted in 21 out of 160 (13.13%) vs 25 out of 44 (56.82%).

DISCUSSION

Endoscopy is a demanding skill that is accomplished only by the use of repetitive motions, such as manipulating the instruments by pushing, pulling, applying torque, and turning control knobs. As with other occupations, these repetitive motions place a strain on our musculoskeletal systems that, if continued, can result in chronic inflammation with resultant progression to permanent damage.

Our data indicates that there is statistically significant difference in the musculoskeletal injuries among gastroenterologists when grouped according to the years of practice (less than 20 years vs. more than 20 years). In our study, the frequency of pain in the hand and wrist in the respondents who were practicing less than 20 years is higher (n= 129, 80.63%) compared with those practicing for more than 20 years (n=28, 63.64%). Thumb pain was seen for those less than 20 years of practice (58 out of 160, 36.25%) versus those more than 20 years in practice (25 out of 44, 56.82%). Shoulder pain is seen in 35 out of 160 (21.88%) practicing less than 20 years vs 16 out of 44 (36.36%) of the respondents practicing for more than 20 years. And lastly, leg cramps is more evident in those practicing less than 20 years, (52 out of 160, 32.5%) as compared with those more than 20 years in practice (6 out of 44, 13.64%). Endoscopists who required treatment for their musculoskeletal injuries were noted to be less common in those practicing for less than 20 years (21 out of 160, 13.13%) versus those more than 20 years in practice (25 out of 44, 56.82%).

Specific aspects of performing endoscopy which may contribute to musculoskeletal pain are as follows: adjusting the tip of angulation controls, torquing with the right hand, and standing for prolonged periods of time. Manipulation of the tip angulation controls and torquing of the endoscope may lead to hand and wrist pain, whereas standing for prolonged periods of time may lead to leg cramps.

On other studies, ERCP and endoscopic ultrasound (EUS) are both procedures which require long endoscopy times with special devices. In the present study, performance of these procedures was not a significant factor associated with pain, due to relatively decreased number of case loads (percentage mean for ERCP 6.00%, p-value 0.16 and EUS 0.42%, p-value 0.24) according to the respondents. Whereas the mean percentage of esophagogastroduodenoscopy (EGD) (50.08%, p-value 0.001) and colonoscopies (43.44%, p-value 0.016) performed per week and right dominant hand (n=199, 97.%, p-value 0.001) were found to be significant. In this regard, more frequent performance of EGD and colonoscopy weekly may be risk factors for the development of the predominant musculoskeletal symptoms. In particular, the torquing technique is very important in the performance of colonoscopy, and it is done frequently and for long periods of time. Furthermore, colonoscopy may require stronger torquing power than any other procedures, including ERCP and EUS. Therefore, torquing of the colonoscope appears to be another risk factor associated with pain.

We know that performing an endoscopy while maintaining a neutral position of the spine and upper extremities may reduce injury. Monitor placement is an especially important determinant of torso and head posture⁶. Monitors should be placed directly in front of the endoscopist while in the working position to avoid rotation and flexion of the cervical spine and should be adjusted to eye level⁷. In this study, as shown in Figure 2, most endoscopists (n=200, 98.4%) indicated that they used height adjustable examination tables. As for monitor position, 164 of 204 (80.5%) endoscopists replied that that monitor was directly in front of the endoscopist and at eye level. There were 123 out of 204 (60.5%) endoscopists replied that some of their monitors are positioned

at the side of the endoscopist. With regard to the manufacturer of the endoscope used, majority of the endoscopists 177 (87%) used Olympus, 24 (12%) used Fujinon, and 3 (1.5%) used other brand (did not specify).

The monitor height should be just below eye level so that the cervical spine is not in extension⁸. Additionally, the bed level should be adjusted to avoid undue flexion of the lower back⁹. Equipment such as cushioned floor mats can also decrease foot discomfort from prolonged standing¹⁰. A two-piece lead apron during fluoroscopic procedures will lessen weight placed on the intervertebral disk spaces, as compared to a single full body shield¹¹. There should also be recognition of muscle fatigue and adequate rest time allowed for recovery between procedures.

In this study as shown in Figure 3A, the most common practice modifications done were stretching exercises ($n = 112$, 55%), taking breaks ($n = 93$, 46%), use of adjustable table ($n=117$, 57%) and less endoscopy ($n = 31$, 15%). There were only 26 (12.5%) endoscopists had no modifications made to their endoscopic practice in response to musculoskeletal injuries incurred due to performing endoscopic procedures.

Therapeutic intervention for pain relief as shown in Figure 3B were found in only 21 (10.5%) endoscopists and 2 (1%) endoscopists underwent splinting/cast for temporary immobilization of injured extremity. Most of the respondents, 100 out of 204 (49.5%) endoscopists did not require any treatment and 98 out of 204 respondents (48%) required only rest for management of musculoskeletal symptoms.

Risk of injury to the endoscopist should be minimized by allowing additional time for anticipated difficult procedures. We must involve ergonomic engineers, equipment manufacturers and occupational therapists in the design of a safe, highly functional endoscopy unit¹². Work related injury can be devastating to the career of an endoscopist. While the safety of the patient is the highest priority in the endoscopy unit, we must equally ensure that the endoscopy unit is not a hazardous place for the endoscopist.

CONCLUSION

Several factors could improve the ergonomic environment in the endoscopy suite. There is clearly a need for comprehensive guidelines presenting best clinical practice for ergonomics. Training among gastroenterologists should include information on the optimal ergonomics in order to help minimize physical discomfort and maximize productivity. Optimizing the ergonomic environment includes attention to posture and position, procedure room equipment, daily case volumes and endoscope design factors.

In conclusion, our data suggest that pain in the hand and wrist may be endoscopy-related. However, endoscopists made few modifications to their practices to prevent pain. More attention to pain prevention appears to be needed. Given the importance of endoscopy in the clinical setting, our results support a further controlled study on this subject in a much larger and more diverse population of endoscopists.

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APPENDIX

Modified Sample Survey Form:

(Source: American Society for Gastrointestinal Endoscopy (ASGE) Web-based Survey⁶; Prevalence and risk factors for musculoskeletal injuries related to endoscopy. Wiriyaporn Ridditid, MD, et al.⁵)

ENDOSCOPY-RELATED MUSCULOSKELETAL INJURIES AMONG GASTROENTEROLOGISTS

SURVEY QUESTIONNAIRE

Name: _____

Age: _____ Gender: _____

Please check the box with your corresponding answers.

Hand Dominance <ul style="list-style-type: none">▪ Right▪ Left	<input type="checkbox"/> <input type="checkbox"/>
Physical Activity Level <ul style="list-style-type: none">▪ Mild▪ Moderate▪ Very Active	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Years of Professional Practice	_____

Endoscopy Workload Parameters

Duration of performing Endoscopy (years) <ul style="list-style-type: none">▪ 1 - 5▪ 6 - 10▪ 11 - 15▪ 16 - 20▪ 21 - 30▪ > 30	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Endoscopic procedures performed per week (number) <ul style="list-style-type: none">▪ 1 - 10▪ 11 - 20	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

<ul style="list-style-type: none"> ▪ 21 - 30 	
Time spent performing endoscopy (hours/week) <ul style="list-style-type: none"> ▪ 1 - 20 ▪ 21 - 40 ▪ 41 - 60 ▪ 61 - 80 ▪ > 80 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Percentage of endoscopic procedures performed per week (%) <ul style="list-style-type: none"> ▪ EGD ▪ Colonoscopy ▪ ERCP ▪ EUS ▪ Enteroscopy 	<hr/> <hr/> <hr/> <hr/> <hr/>

Musculoskeletal Injuries Perceived Related to Endoscopy

Type of Injury <ul style="list-style-type: none"> ▪ Thumb pain ▪ Shoulder pain ▪ Hand/Wrist pain ▪ Neck/ upper back pain ▪ Lower back pain ▪ Hand numbness ▪ Carpal tunnel syndrome ▪ Leg cramps ▪ Others (please specify): _____ 	YES <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	NO <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Experienced injury perceived related to endoscopy <ul style="list-style-type: none"> ▪ Required time-off from endoscopy ▪ Required modifications of practice ▪ Required treatment ▪ Others (please specify): _____ 	YES <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	NO <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Environmental Factors Affecting Endoscopic Procedures

FACTORS		
Use of height-adjustable examination table	YES <input type="checkbox"/>	NO <input type="checkbox"/>
Position of monitor	YES <input type="checkbox"/>	NO <input type="checkbox"/>
<ul style="list-style-type: none"> ▪ Directly in front of endoscopist, at eye level ▪ Other position (e.g. side) 	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Manufacturer of endoscope primarily used	YES <input type="checkbox"/>	NO <input type="checkbox"/>
<ul style="list-style-type: none"> ▪ Olympus ▪ Fujifilm ▪ Others (please specify): _____ 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Modification of Practice and Treatments Done for Endoscopy-Related Injuries

Modification of Practice	YES	NO
	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>

