

# **A FIELD STUDY OF POSTURAL ERGONOMICS IN BARIATRIC SURGERY**



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# CONFLICT OF INTEREST

- ▶ The authors hereby declare that we have no potential conflict of interest to report.

# INTRODUCTION

## ▶ Work-related musculoskeletal disorders (WMSD)

Injuries or disorders of  
the muscles, nerves,  
tendons, joints, cartilage,  
and spinal discs

CAUSED  
BY  
MADE  
WORSE BY



WORK  
ENVIRONMENT



•Bernard BP, editor. U.S. Department of Health and Human Services, Centers for Disease control and Prevention, National Institute of Occupational Safety and Health. Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and lower back. July 1997. DHHS (NIOSH) Publication No. 97-141. Available from: <https://www.cdc.gov/niosh/docs/97-141/>.

# INTRODUCTION

## ▶ WMSD among laparoscopic surgeons - 73-88%

- Back pain
- Neck pain
- Shoulder pain
- Elbow pain
- Wrist and hand pain

## ▶ Career longevity fears

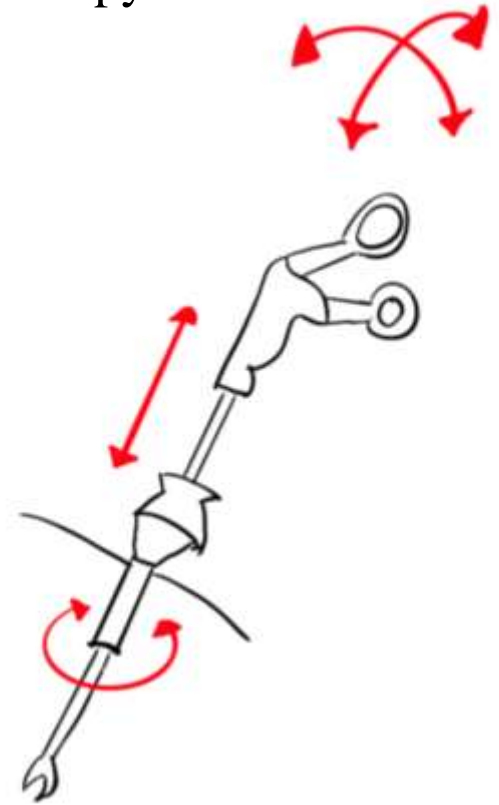


- Epstein S, Sparer EH, Tran BN, et al. Prevalence of Work-Related Musculoskeletal Disorders Among Surgeons and Interventionalists: A Systematic Review and Meta-analysis. *JAMA Surg.* 2018;153(2):e174947. doi:10.1001/jamasurg.2017.4947
- Alleblas CCJ, de Man AM, van den Haak L, Vierhout ME, Jansen FW, Nieboer TE. Prevalence of Musculoskeletal Disorders Among Surgeons Performing Minimally Invasive Surgery: A Systematic Review. *Ann Surg.* 2017 Dec;266(6):905-920. doi: 10.1097/SLA.0000000000002223. PMID: 28306646.
- Michael S, Mintz Y, Brodie R, Assalia A. Minimally invasive surgery and the risk of work-related musculoskeletal disorders: Results of a survey among Israeli surgeons and review of the literature. *Work.* 2022;71(3):779-785. doi: 10.3233/WOR-205072. PMID: 35253672.
- Wells AC, Hollman M, Harper SJF, Forsman M, Hallbeck MS. Operating hurts: a study of EAES surgeons. *Surg Endosc.* 2019 Mar;33(3):933-940. doi: 10.1007/s00464-018-0574-5. Epub 2018 Nov 19. PMID: 30456510; PMCID: PMC6394677.



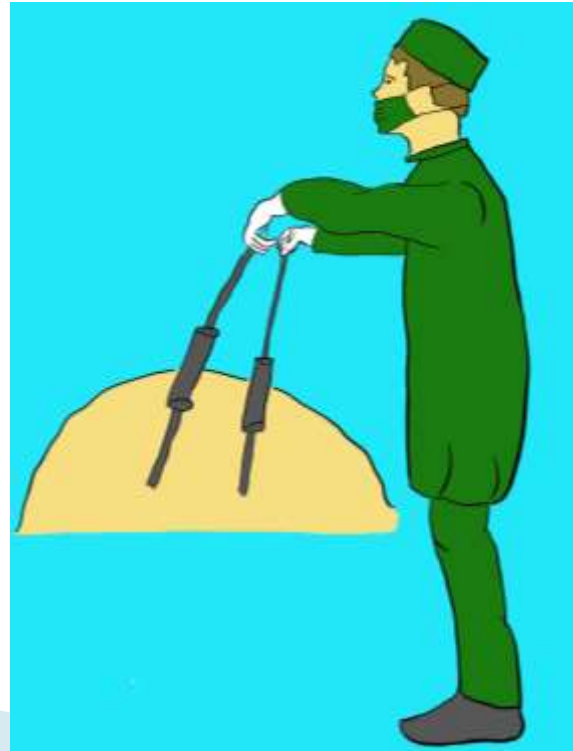
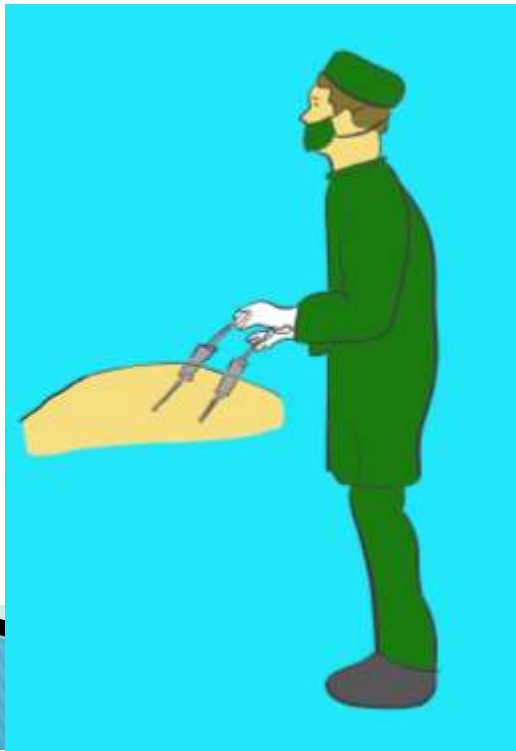
# INTRODUCTION

- ▶ Why the high prevalence of WMSD among laparoscopic surgeons ??
  - decreased degrees of freedom of movement in laparoscopy
  - the decoupling of visual and motor axes
  - limited mobility of the instruments
  - recurrent instrument exchanges



# INTRODUCTION

- ▶ Bariatric surgery – evolved into the most accepted forms of treatment for obesity
- ▶ Difficulties faced by the surgeon
  - Increase in apparent height at which the surgeon operates - obese abdomen
  - Use of longer instruments than conventional laparoscopic surgery




# OBJECTIVES

- ▶ To assess postural ergonomics of bariatric surgeons using the REBA (Rapid Entire Body Analysis) scoring system



# METHODOLOGY

- ▶ **STUDY DESIGN** – Prospective observational study
  - ▶ **PLACE** – Victoria Hospital under Bangalore Medical College and Research Institute, Bangalore
  - ▶ **DURATION** – October 2022 – March 2023
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# METHODOLOGY

- ▶ After obtaining consent, the bariatric surgeons performing the procedures were observed during 15 surgeries.
- ▶ Awkward body postures held for more than 30s or body postures which were repeatedly being used were photographed from lateral and posterior aspects using a high definition camera

# REBA SCORING SYSTEM

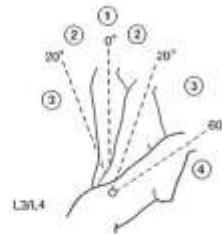
- ▶ REBA - Rapid Entire Body Analysis Scoring
- ▶ Developed by Sue Highnett and Lynn McAtamney in 2000
- ▶ Analyzes the posture of the whole body - including upper limb (arm, forearm, and wrist), trunk, neck and lower extremities
- ▶ Advantages - cost effectiveness, its ease of use and its ability to assess the posture of the whole body.

•Cuixart SN. NTP 601: Evaluation of working conditions: postural load. REBA method (Rapid Entire Body Assessment). National Institute of Safety and Hygiene at work. 2001.

•Highnett S., Mcatamney L. Rapid entire body assessment (REBA) Appl. Ergon. 2000;31:201–205.  
doi: 10.1016/S0003-6870(99)00039-3.

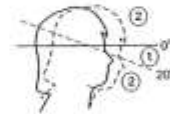
**Trunk**

Movement	Score	Change score:
Upright	1	+1 if twisting or side flexed
0°–20° flexion 0°–20° extension	2	
20°–60° flexion >20° extension	3	
>60° flexion	4	



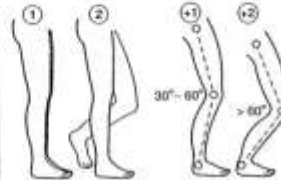
**Neck**

Movement	Score	Change score:
0°–20° flexion	1	+1 if twisting or side flexed
>20° flexion or in extension	2	



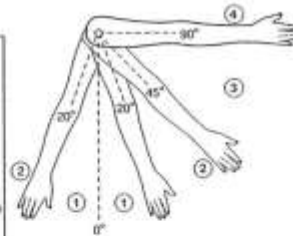
**Legs**

Position	Score	Change score:
Bilateral weight bearing, walking or sitting	1	+1 if knee(s) between 30° and 60° flexion  +2 if knee(s) are >60° flexion (n.b. Not for sitting)
Unilateral weight bearing Feather weight bearing or an unstable posture	2	



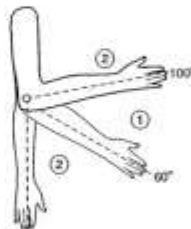
**Upper arms**

Position	Score	Change score:
20° extension to 20° flexion	1	+1 if arm is: • abducted • rotated
>20° extension 20°–45° flexion	2	
45°–90° flexion	3	–1 if leaning, supporting weight of arm or if posture is gravity assisted
>90° flexion	4	



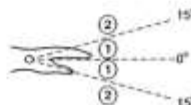
**Lower arms**

Movement	Score
60°–100° flexion	1
<60° flexion or >100° flexion	2



**Wrists**

Movement	Score	Change score:
0°–15° flexion/extension	1	+1 if wrist is deviated or twisted
>15° flexion/extension	2	



# REBA SCORING

# METHODOLOGY

- ▶ Neutral position was defined before the start of the procedure
- ▶ Angles relevant for REBA scoring system were calculated




# METHODOLOGY

REBA SCORE	RIK LEVEL	ACTION
1	Negligible	None necessary
2-3	Low	May be necessary
4-7	Medium	Necessary
8-10	High	Necessary soon
11-15	Very high	Necessary NOW



# METHODOLOGY

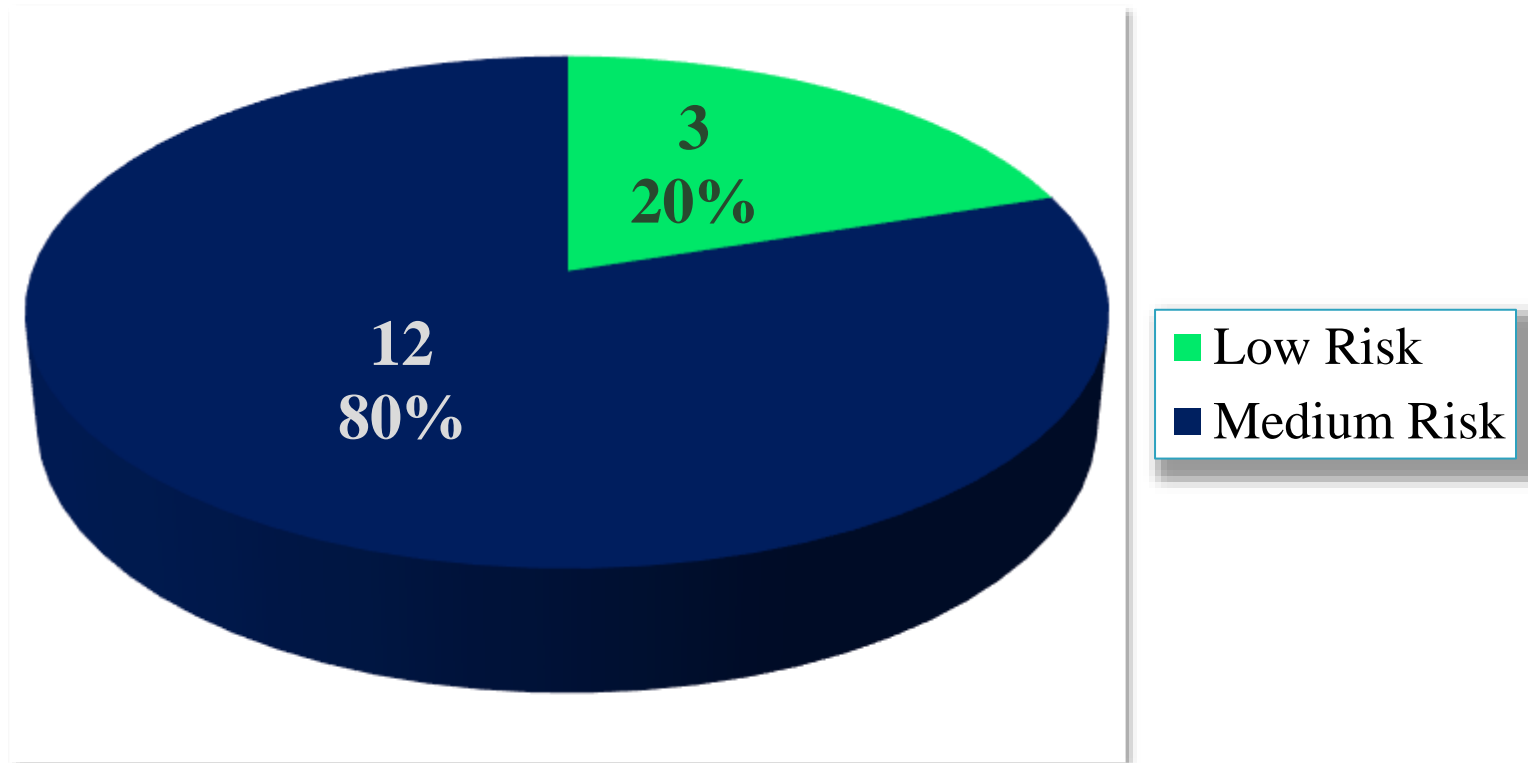
- ▶ Statistical analysis - SPSS 23 software
  - ▶ Descriptive statistics
  - ▶ The REBA scores obtained were correlated with the BMI of the patients using Pearson's correlation coefficient.
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# RESULTS

PARAMETER	RANGE	MEAN	SD
BMI (kg/m <sup>2</sup> )	30.3-60	43.4	8.55
REBA	3-6	4.6	1.08

# RESULTS

## RISK CATEGORIZATION ACCORDING TO REBA SCORE



# RESULTS

POSTURE	DEVIATION FROM NEUTRAL POSITION	
	NUMBER	PERCENTAGE
Trunk	12	80
Neck	12	80
Wrist	11	73.33
Elbow and forearm	6	40
Legs	0	0
Arms	0	0

There was no statistically significant correlation noted between the BMI of the patient and the corresponding REBA scores ( $p > 0.005$ ).

# DISCUSSION

- ▶ Posture is the spatial arrangements of body parts as they align to perform a task.

Vieira ER, Kumar S. Working postures: a literature review. *J Occup Rehabil.* 2004 Jun;14(2):143-59. doi: 10.1023/b:joor.0000018330.46029.05. PMID: 15074366.

# DISCUSSION

## ERGONOMICS IN BARIATRIC SURGERY

- ▶ In this study
  - 80% (12) of the scenarios - medium risk category
  - 20% (3) - low risk category.



# DISCUSSION

## ERGONOMICS IN BARIATRIC SURGERY

> [Surg Endosc. 2019 Jun;33\(6\):1818-1827. doi: 10.1007/s00464-018-6460-1. Epub 2018 Sep 24.](#)

### The prevalence of musculoskeletal injuries in bariatric surgeons

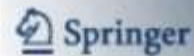
[Salman AlSabah](#)<sup>1</sup>, [Eliana Al Haddad](#)<sup>2</sup>, [Haris Khwaja](#)<sup>2</sup>

[Affiliations](#) + [expand](#)

PMID: [30251136](#) DOI: [10.1007/s00464-018-6460-1](#)

# DISCUSSION

## ERGONOMICS IN BARIATRIC SURGERY



JOURNAL OF ROBOTIC SURGERY

springer.com

*J Robot Surg.* 2007; 1(1): 61–67. Published online 2007 Feb 10. doi: [10.1007/s11701-007-0016-z](https://doi.org/10.1007/s11701-007-0016-z)

PMCID: PMC4247428 | PMID: [25484939](https://pubmed.ncbi.nlm.nih.gov/25484939/)

Postural ergonomics during robotic and laparoscopic gastric bypass surgery: a pilot project

[Elise H. Lawson](#), [Myriam J. Curet](#),<sup>✉</sup> [Barry R. Sanchez](#), [Rob Schuster](#), and [Ramon Berguer](#)

# DISCUSSION

## ERGONOMICS IN BARIATRIC SURGERY

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> [Appl Ergon.](#) 2021 Nov;97:103501. doi: 10.1016/j.apergo.2021.103501. Epub 2021 Jun 22.

### **The ergonomic impact of patient body mass index on surgeon posture during simulated laparoscopy**

Ryan Sers <sup>1</sup>, Steph Forrester <sup>1</sup>, Massimiliano Zecca <sup>1</sup>, Stephen Ward <sup>1</sup>, Esther Moss <sup>2</sup>

Affiliations + expand

PMID: [34167015](#) DOI: [10.1016/j.apergo.2021.103501](#)



# DISCUSSION

## ERGONOMICS IN BARIATRIC SURGERY

Randomized Controlled Trial > *Obes Surg.* 2019 Jan;29(1):137-142.

doi: 10.1007/s11695-018-3496-1.


### Physical and Mental Impact of Laparoscopic Sleeve Gastrectomy on the Surgeon: French vs. American Positions. A Randomized and Controlled Study

José E Carmona <sup>1</sup>, Jorge A Higuerey <sup>2</sup>, Doubraska Gil <sup>2</sup>, Mabel Castillo <sup>2</sup>, Valentina Escalona <sup>2</sup>


Affiliations + expand

PMID: [30187419](#) DOI: [10.1007/s11695-018-3496-1](#)

# LIMITATIONS


- ▶ Small sample size
  - ▶ Assessment of photos captured during the surgery - A continuous real time assessment of the surgeon's postures during the surgery could provide a more accurate analysis.
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# CONCLUSION

- ▶ Most bariatric surgeons face a medium ergonomic risk
  - ▶ Further action is needed by the surgeons to alleviate the symptoms and prevent WMSDs.
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# FUTURE PROSPECTS

- ▶ Bariatric surgery poses a great ergonomic challenge to the surgeons
  - ▶ Further studies in the field are needed to achieve better ergonomic safety.
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**THANK YOU**

**GRAZIE**