Cross-sectional Study: Canadian Portrait of Ergonomics in Bariatric Surgery

Alexandre Marceau[1,2], Justin Wee[1,2], Ahmad Elnahas[1,2], Jeffrey D Hawel[1,2], Christopher M Schlachta[1,2]

[1]Department of General Surgery, Schulich School of Medicine and Dentistry, Western University, London, ON, Canada

[2]Canadian Surgical Technologies & Advanced Robotics (CSTAR), London Health Sciences Centre, University Hospital, London, ON, Canada

Introduction

- Proper ergonomics is crucial for surgeons in the operating room to reduce the risk of musculoskeletal injuries (MSI).
- Work-related injuries are associated with leave of absence, practice modification or early retirement in up to 12% of surgeons and interventionalists[1]. Up to 74%[2] of minimally invasive surgeons express discomfort associated with their work.
- Higher body mass index (BMI) in simulated laparoscopic models has been correlated to increased prevalence of non-neutral surgeon posture[3], especially for a BMI greater than 50 kg/m^2.

Research Objective

- Identify the prevalence and risk factors associated with musculoskeletal injuries in bariatric surgeons.

Methods

Participants:
- General Surgeons with active bariatric surgery practice in Canada in 2024.
- Recruitment conducted over email through publicly available information and provincial general surgery association databases.

Outcomes: Prevalence and risk factors of MSI in bariatric surgeons.

Study design: Cross-sectional study
- Researcher-administered questionnaire conducted over a videoconference platform.
- The questionnaire was designed from a systemic review of current literature on ergonomics in bariatric and minimally invasive surgery, and further improved through focus groups.

Statistical analysis: Multivariate analysis and logistic regression models were used to determine the risk factors of MSI, with odds ratios calculated.
- Potential confounding variables (determined a priori) were included in the final model for biological susceptibility.
- Cohort description was performed using Fisher's Exact Test.

Inductive thematic analysis was used to analyze qualitative data, and themes were described in proportions to illustrate relative importance.

Results

33 Canadian bariatric surgeons interviewed

- 60.6% report MSI with pain on regular basis. 75% of these surgeons sought treatment.
- 27.3% endorse chronic lower back pain.
- 6.1% have current practice impairment secondary to MSI.
- Most common areas of pain:
  - Lumbar spine
  - Cervical spine
  - Shoulders
- Inductive thematic analysis highlighted the following themes:
  - Lack of institutional support for optimizing ergonomics (88%)
  - Endorsed lack of ergonomics education or knowledge (85%)
  - Importance of teaching proper ergonomics to learners (43%)
  - Importance of patient positioning (27%)
  - Importance of surgeon positioning (21%)

Table 1
Demographic Overview of Interviewed Surgeons

Characteristics	All participants (n=33)	MSI (n=20)	No MSI (n=13)	p-value
Years of bariatric surgery (mean ± SD, [range])	12.6 ± 9.0 [1-40]	9.6 ± 9.0 [3-40]	11.3 ± 7.5 [1-25]	0.7390
Height (cm) (mean ± SD, [range])	176.4 ± 8.5 [160-193]	176.9 ± 9.6 [160-193]	175.6 ± 6.9 [160-186]	0.5021
Glove size (mean ± SD, [range])	7.2 ± 0.7 [5.5-8.5]	7.2 ± 0.8 [5.5-8.5]	7.1 ± 0.6 [6-8.5]	0.5174
Female sex (n, %)	7 (21.2%)	5 (15.1%)	2 (6.1%)	0.6756
Fellowship training (n, %)	23 (69.77%)	14 (42.4%)	9 (27.3%)	1.0000

SD: standard deviation, MSI : musculoskeletal injury.

Figure 1
Type and frequency of musculoskeletal injuries

Site of MSI	Frequency (N)	Prevalence (%)
Lumbar spine	9	27,3
Cervical spine	5	15,1
Shoulders	5	15,1
Knees	4	12,1
Hands	4	12,1
Elbows	2	6,1
Migraines	2	6,1
Feet	1	3,0
Clavicle	1	3,0

MSI : musculoskeletal injury.

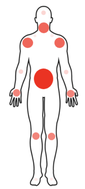


Table 2
Odds Ratio Estimates and Wald Confidence Intervals

Odds ratio	Estimate	95% Confidence limits	
Years of bariatrics	1.125	0.239	5.306
Fellowship training	1.644	0.254	10.630
Glove size	5.602	0.914	34.318
Gender	0.204	0.018	2.317
Patient position	0.513	0.067	3.904
Percentage of bariatrics in practice	1.037	0.156	6.887
Preferred bariatric procedure	1.792	0.245	13.105

Discussion

- Prevalence of MSIs amongst Canadian bariatric surgeons is high (60.6%).
- Factors trending towards more injuries: (1) larger glove size (≥ 7.5), (2) Roux-en-Y gastric bypass dominant practice, and (3) surgeons with fellowship training.
  - None of these findings were statistically significant.
- Non-contributing factors to MSI included: (1) percentage of elective practice comprised of bariatrics, (2) patient positioning.
  - Depending on role of surgeon (primary operator vs assistant), patient positioning may play a greater role in prevalence of MSI. Many surgeons felt split leg position was more ergonomic for the primary operator but challenging for the first assistant.
- Most surgeons value the importance of teaching proper ergonomics early in surgical career to residents and fellows.
- Workplace evaluation by occupational therapist was felt to be a benefit to surgical team.
- Limitations of this study include: self-reported data (volunteer and response bias), lack of information regarding evolution of MSIs over time, small sample size (n=33).

Conclusion

- MSIs are prevalent amongst Canadian bariatric surgeons.
- Additional education and resources should be allocated towards ergonomics to avoid current and future practice impairments amongst surgeons.
- Future research should explore the benefits of the robotic platform on bariatric surgery ergonomics and identify the impact of more resource allocation in ergonomics by institutions.

References

[1] S. Epstein et al., "Prevalence of Work-Related Musculoskeletal Disorders Among Surgeons and Interventionalists: A Systematic Review and Meta-analysis," (in eng), JAMA Surg, vol. 153, no. 2, p. e174947, Feb 21 2018, doi: 10.1001/jamasurg.2017.4947.

[2] C. C. J. Alleblas, A. M. de Man, L. van den Haak, M. E. Vierhout, F. W. Jansen, and T. E. Nieboer, "Prevalence of Musculoskeletal Disorders Among Surgeons Performing Minimally Invasive Surgery: A Systematic Review," (in eng), Ann Surg, vol. 266, no. 6, pp. 905-920, Dec 2017, doi: 10.1097/sla.0000000000002223.

[3] R. Sers, S. Forrester, M. Zecca, S. Ward, and E. Moss, "The ergonomic impact of patient body mass index on surgeon posture during simulated laparoscopy," (in eng), Appl Ergon, vol. 97, p. 103501, Nov 2021, doi: 10.1016/j.apergo.2021.103501.

[4] G. Mathew et al., "STROCSS 2021: Strengthening the reporting of cohort, cross-sectional and case-control studies in surgery," (in eng), Int J Surg, vol. 96, p. 106165, Dec 2021, doi: 10.1016/j.ijsu.2021.106165.