Reducing Musculoskeletal Discomfort through Ergonomic Optimization in Robotic Surgery

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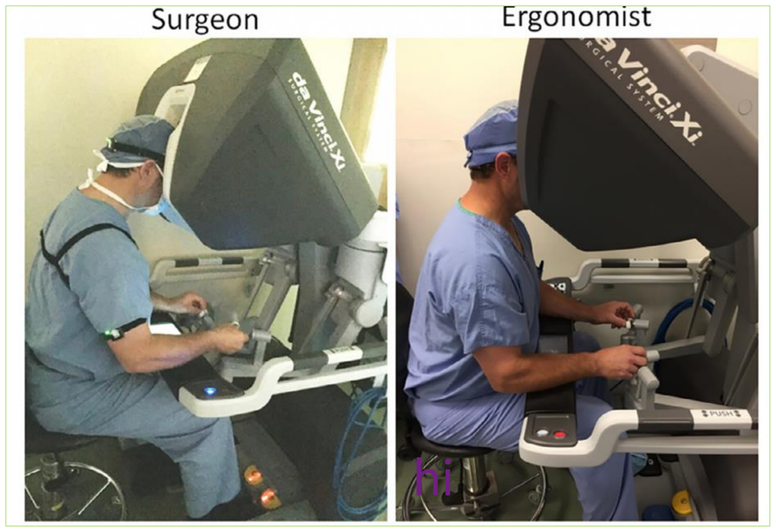
INTRODUCTION

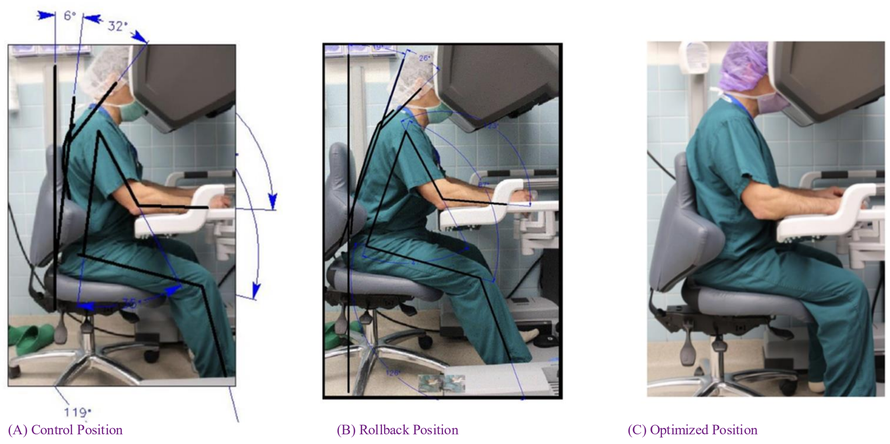
- The da Vinci Surgical System has seen rapid adoption in minimally invasive surgery, in part due to its ergonomic advantages over traditional laparoscopy.
- Despite benefits, the console's seated posture introduces new ergonomic challenges due to to limited console adjustability..
- Currently, no validated ergonomic guidelines exist to ensure optimized surgeon posture.



Study Aim: To evaluate whether targeted ergonomic optimization of the da Vinci XI surgical console reduces musculoskeletal discomfort among robotic surgeons.

METHODS

- Multi-surgeon quality improvement project using the da Vinci XI system at a 160-bed community hospital
- Participants: Attending surgeons (8 total) across general, bariatric, colorectal and thoracic specialties..
- Preliminary Survey: Collected demographics, baseline pain, and ergonomic challenges
- Study Conditions:
  - Control – baseline positioning at console
  - Intervention – ergonomic adjustments (seat, console height, armrests, foot pedals)



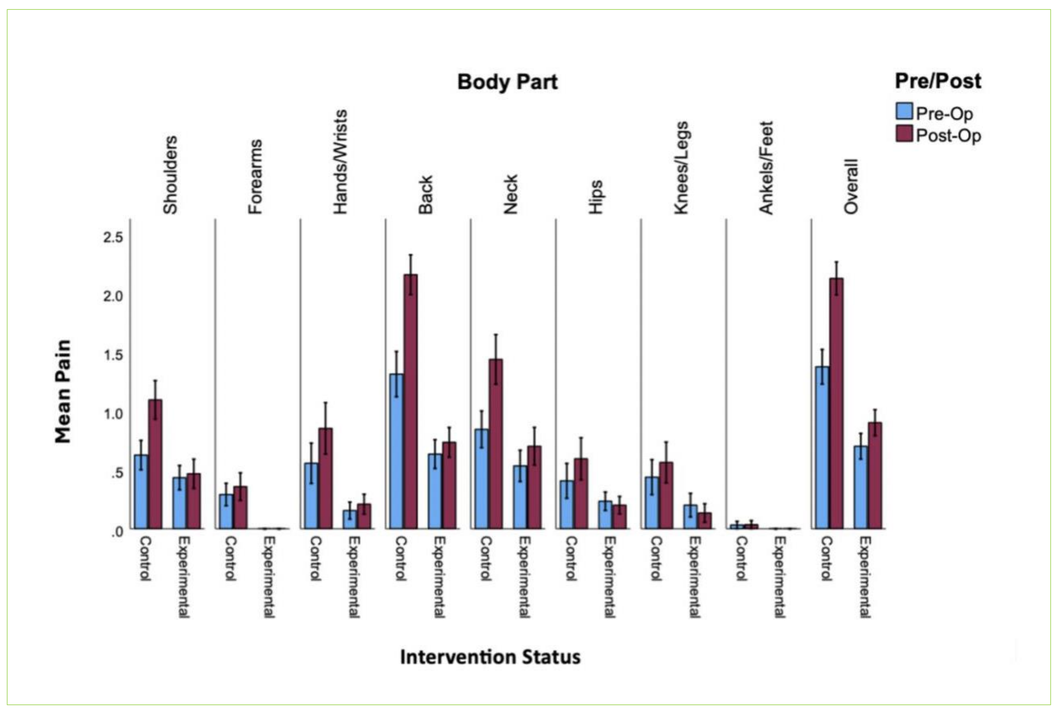
(A) Control Position (B) Rollback Position (C) Optimized Position

- Pain scores pre- and post-surgery via electronic surveys (0–5 scale)
- Mixed-effects modeling with pairwise comparisons for intervention vs. control

RESULTS

Painful MSK Symptoms Felt After Performing Robotic Surgery	Surgeons (%)
Head and Face	12.50
Cervical	**50.00**
Shoulders	**62.50**
Trapezius	12.50
Forearms	12.50
Wrists	25.00
Fingers	37.50
Thoracic Spine	12.50
Hip	12.50
Quadricep	12.50
Lumbar Spine	37.50
Thoracic Spine	12.50
Foot and Ankle	12.50

MSK Pain Symptom Persistence Post-Surgery	Surgeons (%)
Only during surgery	12.50
1-2 hrs post-surgery	**50.00**
3-5 hrs post-surgery	12.50
6-10 hrs post-surgery	0
Persistent daily	25.00
Does MSK Pain Arise from Performing Robotic Surgeries Opposed to other Surgeries	
No	0
Probably not	12.50
Might or might not	12.50
Probably yes	**75.00**
Definitely Yes	0
Level of Distraction During Surgery due to MSK Pain	
Not distracting	37.50
Somewhat Distracting	**50.00**
Distracting	12.50
Often distracting	0
Very distracting	0



DISCUSSION/CONCLUSION

- Ergonomic optimization reduced post-op pain across multiple body regions
  - Greatest improvements in **back, neck, and shoulders**
- Control group: pain consistently worsened post-op
- Intervention group: blunted or minimized pain increases
- Supports evidence that console/seat adjustments improve surgeon comfort without affecting performance
- Highlights the need for standardized ergonomic guidelines in robotic surgery

CONTACT/REFERENCES

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