

# The Surgeon Ergonomic Impact of a Tubular-based Digital Camera to Perform a Posterior Cervical Foraminotomy with the Patient in a Seated Position: *Case Report and Surgical Technique Description with Ergonomic Assessment*

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## Disclosure

**I have no financial relationships to disclose.**

# Introduction

- A posterior cervical decompression is a common spine procedure that can be performed with the patient in a prone or **sitting position**.
- The sitting position provides the potential benefit of more **facile retraction of surrounding soft tissues, increased operative field and fluoroscopic visualization**, as well as **decreased epidural bleeding**.
- Unfortunately, the **surgeon's ergonomics** of this positioning can be quite challenging when using the standard operative microscope to perform the procedure and may cause musculoskeletal harm to the surgeon.

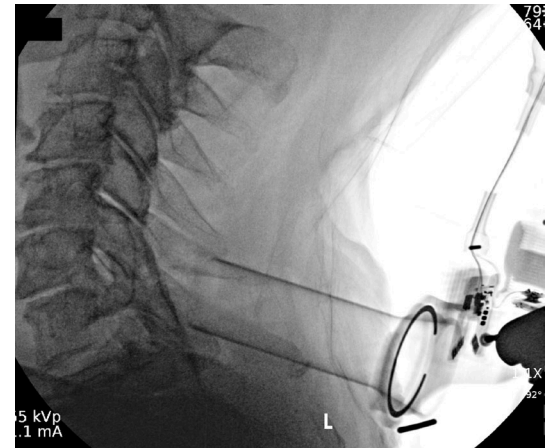
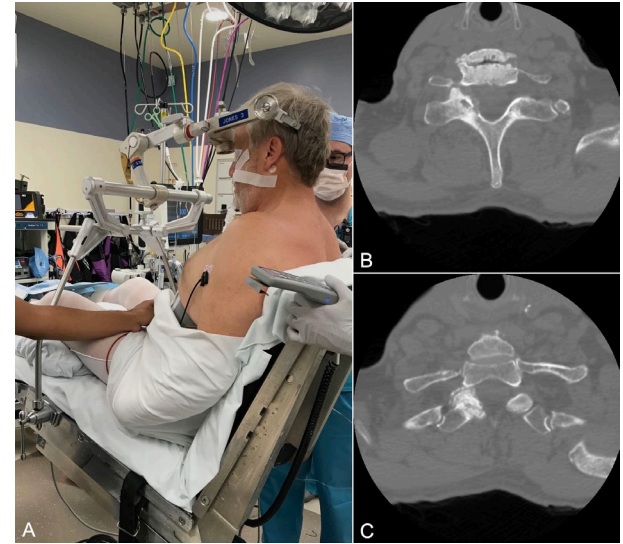


In this case report, we introduce a tubular-based camera system, with video projection onto a screen, to potentially alleviate negative ergonomic impacts with this procedure.

Utilizing the Rapid Entire Body Assessment (REBA) scoring system, we provide objective evidence of the surgeons' ergonomic changes when using a microscope and tubular-based camera system for this procedure.

# Methods

- A sterile digital camera was brought into the field to perform a sitting foraminotomy were completed through the tube retractor at both C6-7 and C7-T1 levels.
- 2 surgeons: 5'10" and 5'0"
- For one half of the procedure, a typical neurosurgical operative microscope was brought into the field to evaluate surgeon ergonomics utilizing the baseline Rapid Entire Body Assessment (REBA) scores for two surgeons of differing stature.
- The digital camera was inserted onto the tubular retractor and REBA scores were calculated.



# Methods - REBA

- (Rapid Entire Body Assessment) REBA is a **postural targeting method** for estimating the risks of work-related entire body disorders.
- A REBA assessment provides a quick and systematic assessment of the **complete body postural risks** to a worker.
- The analysis can be conducted before and after an intervention to **demonstrate that the intervention has worked to lower the risk of injury**

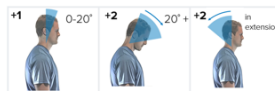
## REBA Employee Assessment Worksheet

Task Name:

Date:

### A. Neck, Trunk and Leg Analysis

#### Step 1: Locate Neck Position



Step 1a: Adjust...  
If neck is twisted: +1  
If neck is side bending: +1

#### Step 2: Locate Trunk Position



Step 2a: Adjust...  
If trunk is twisted: +1  
If trunk is side bending: +1

#### Step 3: Legs



#### Adjust:

#### Step 4: Look-up Posture Score in Table A

Using values from steps 1-3 above, Locate score in Table A

#### Step 5: Add Force/Load Score

If load < 11 lbs.: +0  
If load 11 to 22 lbs.: +1  
If load > 22 lbs.: +2  
Adjust: If shock or rapid build up of force: add +1

#### Step 6: Score A, Find Row in Table C

Add values from steps 4 & 5 to obtain Score A. Find Row in Table C.

#### Scoring

1 = Negligible Risk  
2-3 = Low Risk. Change may be needed.  
4-7 = Medium Risk. Further Investigate. Change Soon.  
8-10 = High Risk. Investigate and Implement Change  
11+ = Very High Risk. Implement Change

### Scores

Table A	Neck											
	1				2				3			
Legs	1	2	3	4	1	2	3	4	1	2	3	4
Trunk Posture	1	2	3	4	1	2	3	4	1	2	3	4
Score	4	3	5	6	7	5	6	7	8	6	7	8
	5	4	6	7	8	6	7	8	9	7	8	9

Table B	Lower Arm					
	1			2		
Wrist	1	2	3	1	2	3
Upper Arm	1	2	3	2	3	4
Score	3	4	5	4	5	5
	4	4	5	5	5	6
	5	6	7	8	7	8
	6	7	8	8	8	9

Score A	Score B											
	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	3	3	4	4	5	6	7	7
2	1	2	2	3	4	4	5	6	6	7	7	8
3	2	3	3	4	5	6	7	7	8	8	8	8
4	3	4	4	4	5	6	7	8	8	9	9	9
5	4	4	4	5	6	7	8	8	9	9	9	9
6	6	6	6	7	8	8	9	9	10	10	10	10
7	7	7	7	8	9	9	10	10	10	11	11	11
8	8	8	8	9	10	10	10	10	10	11	11	11
9	9	9	9	10	10	10	10	10	10	11	11	12
10	10	10	10	10	11	11	11	11	11	12	12	12
11	11	11	11	11	12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12	12	12	12	12	12

Table C Score + Activity Score = REBA Score

### B. Arm and Wrist Analysis

#### Step 7: Locate Upper Arm Position:



Step 7a: Adjust...  
If shoulder is raised: +1  
If upper arm is abducted: +1  
If arm is supported or person is leaning: -1

#### Step 8: Locate Lower Arm Position:



#### Step 9: Locate Wrist Position:



Step 9a: Adjust...  
If wrist is bent from midline or twisted: Add +1

#### Step 10: Look-up Posture Score in Table B

Using values from steps 7-9 above, locate score in Table B

#### Step 11: Add Coupling Score

Well fitting Handle and mid range power grip, **good: +0**  
Acceptable but not ideal hand hold or coupling acceptable with another body part, **fair: +1**  
Hand hold not acceptable but possible, **poor: +2**  
No handles, awkward, unsafe with any body part, **Unacceptable: +3**

#### Step 12: Score B, Find Column in Table C

Add values from steps 10 & 11 to obtain Score B. Find column in Table C and match with Score A in row from step 6 to obtain Table C Score.

#### Step 13: Activity Score

+1 1 or more body parts are held for longer than 1 minute (static)  
+1 Repeated small range actions (more than 4x per minute)  
+1 Action causes rapid large range changes in postures or unstable base



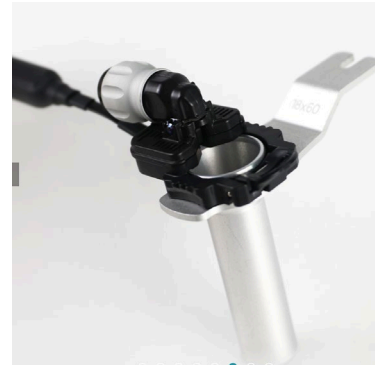
# Results:

- The procedure was completed in 53 minutes without any intraoperative complications and the surgeons subjectively reported less muscle strain and fatigue during use of the tubular-based camera system.
- While using the neurosurgical operative **microscope**, the surgeon's neck is flexed forward, the arms are extended, and the stance is widened.
- The smaller statured surgeon's arms were almost at a complete 90 degrees straight out from her body.
- The taller-stature surgeon scored a 5 on the initial REBA scale and the second, shorter-stature surgeon scored a 6, **placing both in the medium risk category.**
- Once the **tubular-based camera was placed**, the neck position returns to neutral, the arms are closer to a natural 90-degree bend at the elbow and the stance is at shoulder width.
- Both surgeon's repeated REBA scores were a 3, **placing them in the low-risk category.**



# Conclusion

- Use of **the tubular-based digital camera system** during a sitting posterior cervical operation **improves the ergonomics of the surgeon**, objectively shown by improved REBA scores intraoperatively.
- Subjectively, **both surgeons felt improved comfort** with use the camera.
- This enabling technology can serve as a valuable adjunct in sitting posterior cervical operations compared to a traditional operative microscope.



# Thank you!



Please reach out with any questions: [Philip.Louie@vmfh.org](mailto:Philip.Louie@vmfh.org)