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The Telehealth Spine Physical Examination: A Practical Approach Learned During the COVID-19 Pandemic

Zeeshan M. Sardar, Josephine R. Coury, Andrew J. Luzzi, Mark Weidenbaum, K. Daniel Riew

■ **BACKGROUND:** The COVID-19 pandemic has led to a surge in the use of telehealth visits across the country to minimize in-person visits and to limit the spread of COVID-19. To date, no standards or outlines for telehealth spine examinations have been detailed and many surgeons simply defer the physical examination when performing telehealth visits. Nevertheless, just as physical examination of the spine is an integral part of live clinical encounters, appropriately modified physical examinations should also be part of virtual visits.

■ **METHODS:** In this study we provide our methodology for guiding providers and patients in efficiently performing telehealth spine examinations.

■ **RESULTS:** The study details steps for efficiently performing a physical examination in the telehealth setting. Our written suggestions are supplemented with photographs and video recordings to help streamline the virtual examination.

■ **CONCLUSIONS:** An effective and efficient spine physical examination can be performed during telehealth visits. Future directions include verifying the findings from our virtual physical examination with in-person examinations.

pandemic has led to a surge in the use of telehealth across the country to minimize in-person visits and to limit the spread of COVID-19. This surge in telehealth has resulted from ease of regulations to allow greater use of video-based technology, waiving of copayments for telehealth visits, and changing reimbursement by government and private insurers for a growing array of telemedicine offerings.^{1,2} This response has allowed for the rapid increase in telehealth visits and stimulated their extension into new specialties. Several studies have found a significant increase in telehealth services in orthopedic and neurosurgery departments in direct response to COVID-19.^{3,4}

In the setting of spine surgery, telemedicine had been previously used as an effective screening tool in underserved areas or hospitals without a spine specialist.⁵⁻⁸ Telemedicine was also used as a technique for postoperative visits and in managing chronic lower back pain without surgical pathology.⁹⁻¹¹ During the COVID-19 pandemic, the effectiveness of telemedicine in diagnosing operative spinal pathologies has been questioned. Donnally et al. noted that conditions requiring emergency spine surgery presented with such obvious symptoms, such as acute incontinence or inability to ambulate, that they could easily be discovered during a telemedicine visit.¹² However, that paper questioned the effectiveness of telemedicine to provide a thorough spine and neurologic physical examination for non-urgent matters.¹²

The purpose of this study is to provide a guide for a standard spine physical examination during a telehealth visit. To date, no such guide for a telemedicine spine physical examination has been developed. Anecdotally, many surgeons decide to defer the physical examination when performing a telehealth visit as there is perception that a neurologic examination cannot be performed via a video visit. Our goal is to provide a thorough description, augmented with photographs and video recordings, of how to conduct a virtual spine examination that can accomplish goals that are as close as possible to an in-person examination.

INTRODUCTION

Telehealth is a branch of health care using electronic information and telecommunications to provide health care services virtually without an inpatient visit. The COVID-19

Key words

- COVID-19
- Spine
- Telehealth
- Virtual examination

Abbreviations and Acronyms

COVID-19: Coronavirus disease 2019

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Citation: *World Neurosurg.* (2021) 154:e61-e71.
<https://doi.org/10.1016/j.wneu.2021.06.116>

Journal homepage: www.journals.elsevier.com/world-neurosurgery

Available online: www.sciencedirect.com

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Table 1. Cervical Spine Examination Maneuvers

Neurologic Assessment	Instruction to Patient
Cervical spine range of motion	Turn your head from side to side, then touch your chin to your chest, and finally extend your neck all the way back.
Equivalent of Lhermitte's sign	When you touched your chin to your chest, did that cause a shock like sensation down your arms/legs?
Equivalent of Spurling's sign	Extend your neck all the way back and tilt/rotate your head towards the affected side. Did that cause the pain you have been experiencing? Did it reproduce the pain in posterior neck? down your arm?
Examination for pain relief indicating radiculopathy	Next place your hands on your head, does it cause relief of your pain?

METHODS

Prior to the Visit

Once a telehealth visit has been scheduled, the patient would be instructed to ideally have a friend or family member close by to help with the visit and obtain the required equipment. The equipment needed includes regular household items such as a piece of paper, a pen, a rubber band or hair tie, and a heavy object such as a gallon of water or milk, a bag, or a heavy book. Lastly, the patient should be instructed to wear loose fitting clothing and shorts for their telehealth visit.

The Visit

The history and physical examination both form the core of evaluating a patient. Taking the appropriate history should be no

different than seeing a patient in person. Subsequently, the physical examination starts in a sitting position. We start with observing the range of motion in the patient's neck. Several provocative tests are then performed, as detailed in [Table 1](#) and [Figure 1](#).

The next part of the physical examination evaluates strength and sensation of the patient's upper and lower extremities. The patient should be instructed that this part of the examination is to assess neurologic status, not assess or reproduce pain. It should be clarified that the assessment is whether they can feel light touch. Sensation should be described as normal, abnormal, or absent. Although there can be significant variation in dermatomes between individuals and that noted in classic texts, for primary screening we use the sensory areas as listed in [Table 2](#). However, a valuable technique is to ask the patient if they have any areas of

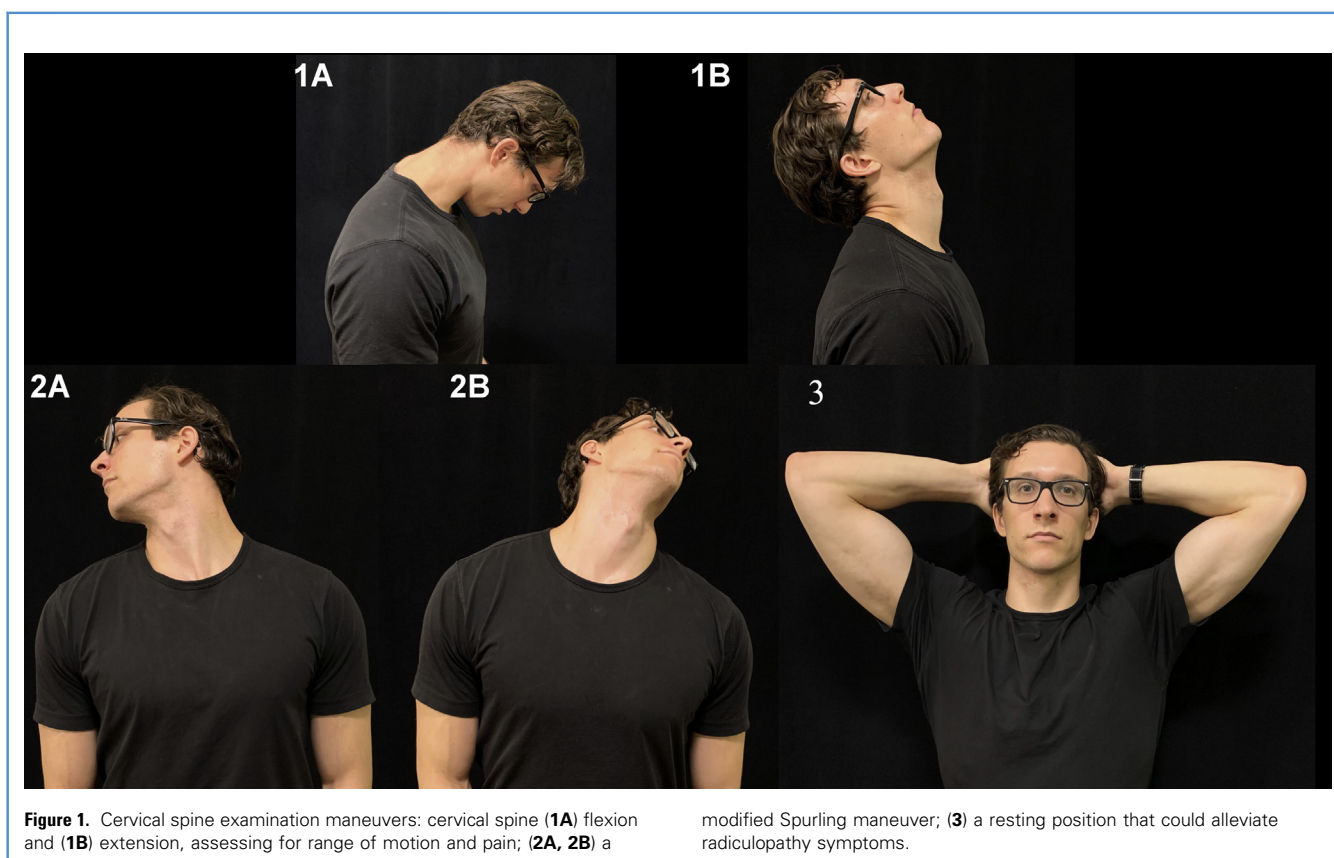


Figure 1. Cervical spine examination maneuvers: cervical spine (1A) flexion and (1B) extension, assessing for range of motion and pain; (2A, 2B) a

modified Spurling maneuver; (3) a resting position that could alleviate radiculopathy symptoms.

Table 2. Sensory Areas Examined for the Upper and Lower Extremity

Upper Extremity	Lower Extremity
Sensory area	Sensory area
Lateral deltoid	Medial upper thigh
Dorsum of thumb	Medial knee
Dorsum of middle finger	Medial ankle
Dorsum of small finger	Dorsum of first web space
Medial elbow	Lateral heel

decreased sensation in their extremities and to note those areas. The sensory areas should be touched lightly with one finger (Figures 2 and 3). Sensory and motor examination of the upper extremities is performed before progressing to the lower extremities.

After sensation of the upper extremity has been assessed, motor strength must be evaluated. During this part of the examination, the patient should be instructed to grab their required equipment: a piece of paper, a pen, a rubber band or hair tie, and a heavy object. Instructions and maneuvers to assess strength are described in Table 3 and demonstrated by Figure 4; each should be performed with the heavy object or resistance. If they are unable to perform the test with the heavy object due to weakness, then the test may be repeated without the heavy object to determine if the strength is grade 3 or less. This will allow differentiation of strength on a 0–5 motor strength scale. Differentiating between grade 4 and grade 5 strength is based on patient's feeling of subjective weakness when comparing to the contralateral side. Alternatively, if a friend or family member is present during the encounter, they can be asked to help with strength testing.

Patients with complaints of hand weakness can buy an inexpensive dynamometer online that they can use to keep track of their hand strength and compare their strength to the contralateral side. They can assess their hand strength every few days to track if their strength is worsening or improving.

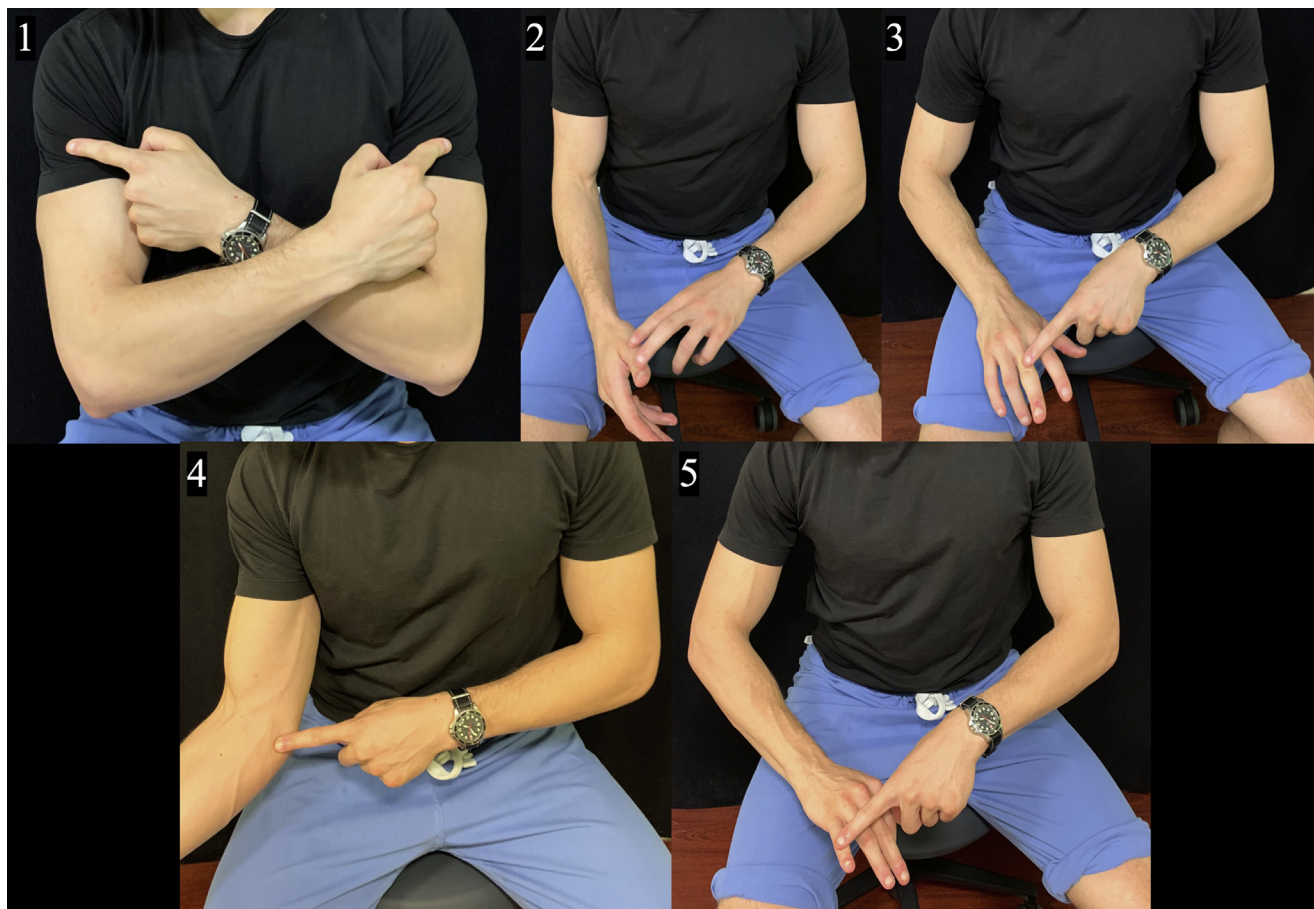


Figure 2. A patient demonstrating upper extremity sensory points: (1) lateral deltoid; (2) dorsum of thumb; (3) dorsum of middle finger; (4) dorsum of small finger; (5) medial elbow.



Figure 3. A patient demonstrating lower extremity sensory points: (1) medial upper thigh; (2) medial knee; (3) medial ankle; (4) dorsum of first web space; (5) lateral heel.

Table 3. Motor Strength Examination of the Upper Extremity

Neurologic Assessment	Instruction to Patient
Shoulder abduction and flexion (C5)	Raise your arm to the side and then above your head.
Elbow flexion (C5, C6)	Bend your arm at the elbow.
Wrist extension (C6, C7)	With your palm facing down, bend your wrist back towards your face.
Wrist flexion (C7)	Turn your wrist with the palm facing up, then bend your wrist towards your face.
Elbow extension (C7)	Turn to the side, tuck your elbows in and back, then straighten your elbow.
Finger abduction (C8, T1)	Place a rubber band around your fingers and spread them.
Finger flexion (C8, T1)	Grip pen a pen in your hand making a fist and attempt to remove it with your other hand.
Finger adduction (C8, T1)	Pinch a piece of paper between your small and ring finger and attempt to remove it with your other hand.
Finger opposition (C8, T1)	Pinch a piece of paper between your small finger and thumb and attempt to remove it with your other hand.

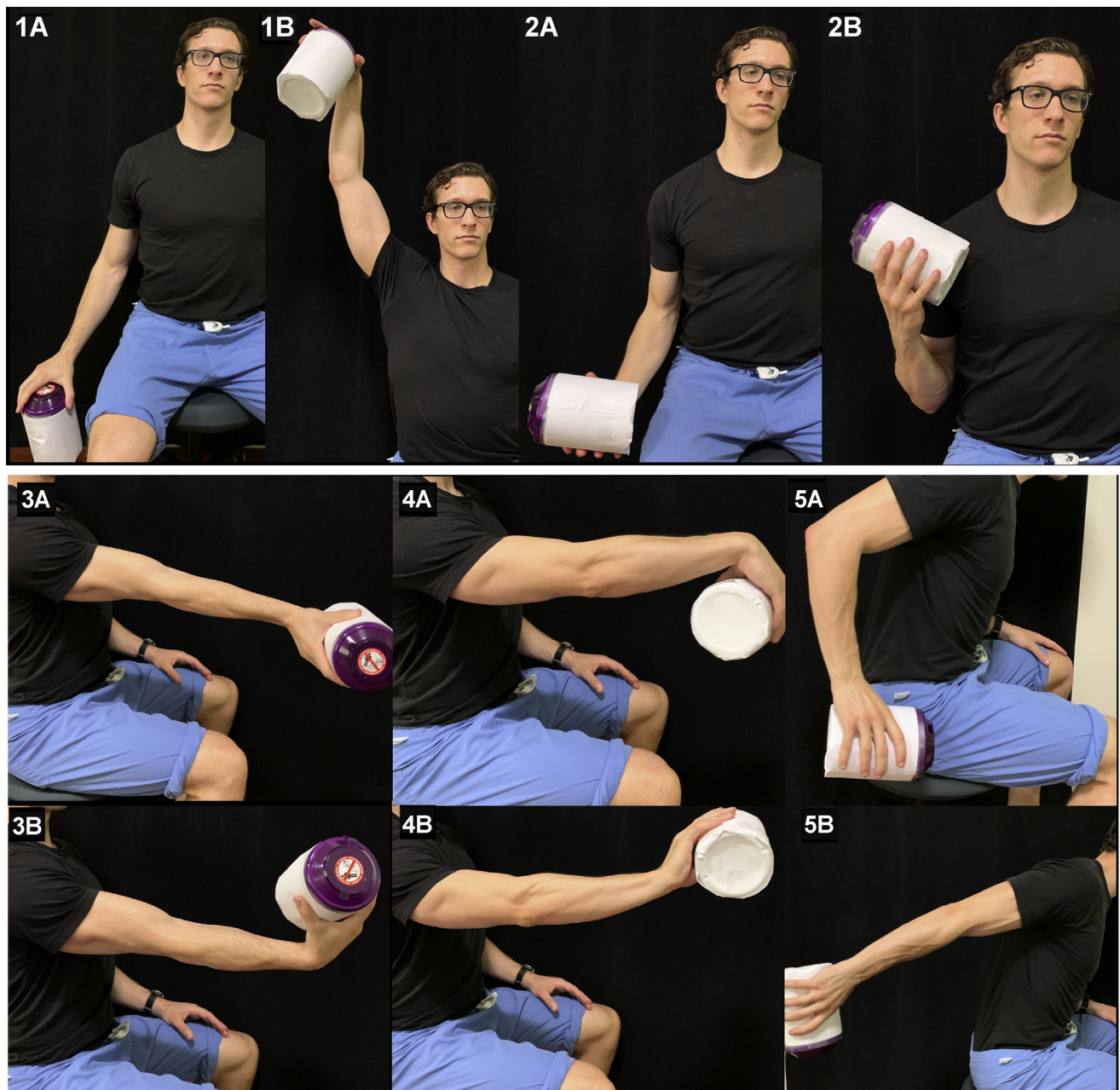


Figure 4. A patient demonstrating upper extremity motor examination: (1A, 1B) arm abduction, deltoid; (2A, 2B) elbow flexion, biceps; (3A, 3B) wrist flexion; (4A, 4B) wrist extension; (5A, 5B) elbow extension, triceps; (6)

finger flexion; (7) finger abduction; (8) finger adduction; (9) finger apposition. (Continues)

After sensation and strength are performed with the upper extremities, sensation should be examined in the lower extremities. The motor assessment for the lower extremities should be performed as per [Table 4](#) and [Figures 5–7](#). At the start of the examination, the greater trochanters should be palpated by the patient and assessed for tenderness ([Table 5](#)).

When assessing the patient's lower extremity strength, the patient will be asked to stand and walk on their toes, heels, and with a tandem gait ([Figure 7](#)). A family member or friend should be asked to hold the camera at a distance. When standing, the patient should be asked to raise their shirt to assess their back ([Figure 8](#)). During this part of the examination, the patient's

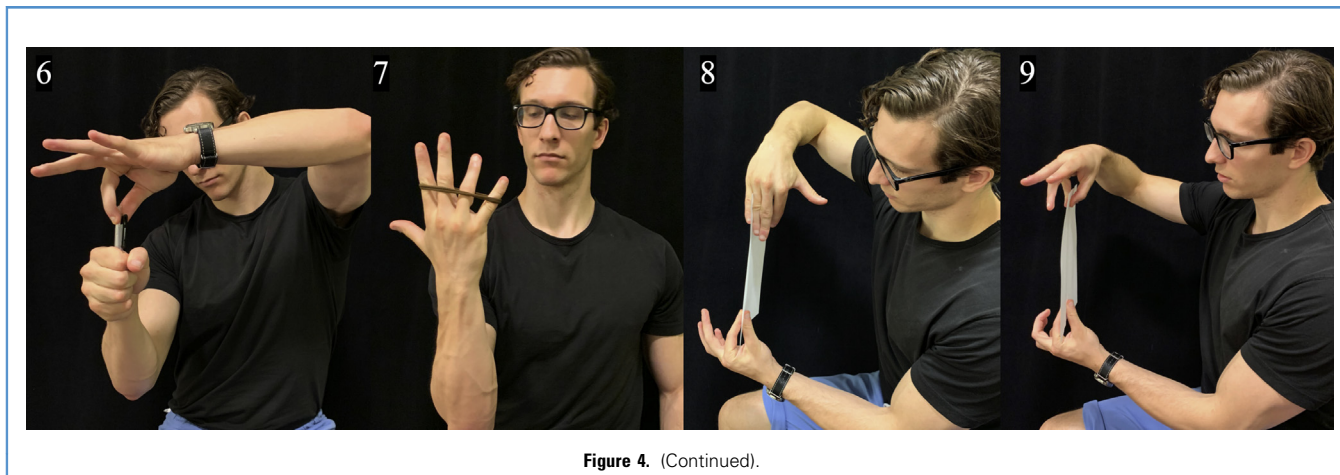


Figure 4. (Continued).

general appearance and nourishment should be assessed. The patient should be assessed from the front for shoulder and chest symmetry. From the side, kyphosis and lordosis should be assessed. Last, the patient should turn away from the camera and their back should be assessed for shoulder or flank asymmetry. The patient should be asked to point with 1 finger where their back pain is the worst. If the pain radiates, the patient should trace the path of their pain. While standing, the patient should also perform a Romberg test, with a family member or friend nearby. The patient can stand with their eyes closed and arms out in front of them (Table 5, Figure 9). Last, the patient should attempt to perform a deep squat to assess strength and balance in the proximal muscles of the lower extremity (Figure 9). The patient should be instructed to have a chair in front of them to hold on to and use for help if they cannot otherwise get up from a squat.

DISCUSSION

This paper details steps for a telehealth spine physical examination with instructions to patients with photos and videos. This

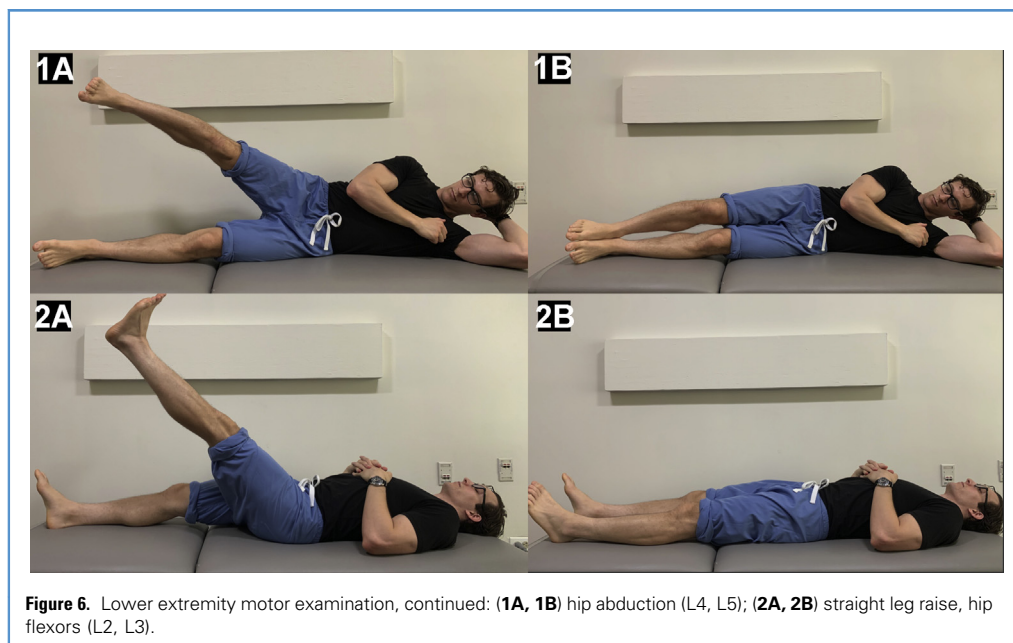
examination should take approximately 5–7 minutes and can provide reliable information to assess a patient's neurological status. A checklist can be seen in the Appendix with a full detailed examination. No previous studies have detailed such steps for a comprehensive telehealth spine physical examination. This outline compares to a physical examination detailed for sports medicine providers by Tanaka et al.¹³

The ability to perform a comprehensive neurologic physical examination during a telehealth visit has many benefits for both patients and physicians. For patients, telehealth visits are safe, they limit COVID-19 exposure, they improve access to remote areas, and they decrease travel time while improving convenience.¹⁴ In our practice during the height of COVID-19, majority of clinic visits were performed virtually, unless requiring a physical suture removal or dressing change, for example. Now, with many vaccinated patients and increasing in-person visits, telehealth is primarily used to increase access for patients with a long commute, for postoperative patients, for unvaccinated or high-risk patients concerned with hospital exposure, and for out-of-state consultations. Patients in the past would travel from other states to visit with several of our surgeons. Davis et al., in a study of 354 patients using telehealth, estimated a total savings of more than \$48,000 in time and travel.¹⁵ Another benefit of telehealth visits is that patients with concerning findings can also be triaged for an urgent in-person visit or for advanced imaging studies. Patients with symptoms concerning for rheumatologic diseases or hip pathology can be triaged to more appropriate specialties. Patients with benign imaging studies can be referred to physical therapy or to receive corticosteroid injections. One disadvantage of telehealth physical examination is the legality of prescribing medications. Studies have suggested that telehealth pain medication prescription could potentially worsen the opioid epidemic.¹⁶ As such, we do not recommend that prescriptions, particularly pain medication, be prescribed from a telehealth visit—although prescriptions for imaging for further workup are appropriate during a telehealth visit.

Further studies should be performed to assess the accuracy of a telehealth spine physical examination. A comparison of diagnoses made from telehealth versus those made with in-person spine physical

Table 4. Motor Strength Examination of the Lower Extremity

Neurologic Assessment	Instruction to Patient
Hip flexion (L2, L3)	While sitting, bend your knee to your chest. [Also tested when patient is asked to perform a squat.]
Knee extension (L3,L4)	Extend your knee so your leg is straight. [Also tested when patient is asked to perform a squat.]
Big toe extension (L5, S1)	Lift your big toe up from the ground and push down with one finger, try to resist the pressure from your finger. [Compare the 2 sides to check for a difference.]
Hip abduction (L4,L5)	Laying on your side, lift your leg up in the air.
Ankle dorsiflexion (L4,L5)	Walk on your heels.
Ankle plantar flexion (S1,S2)	Walk on your toes.



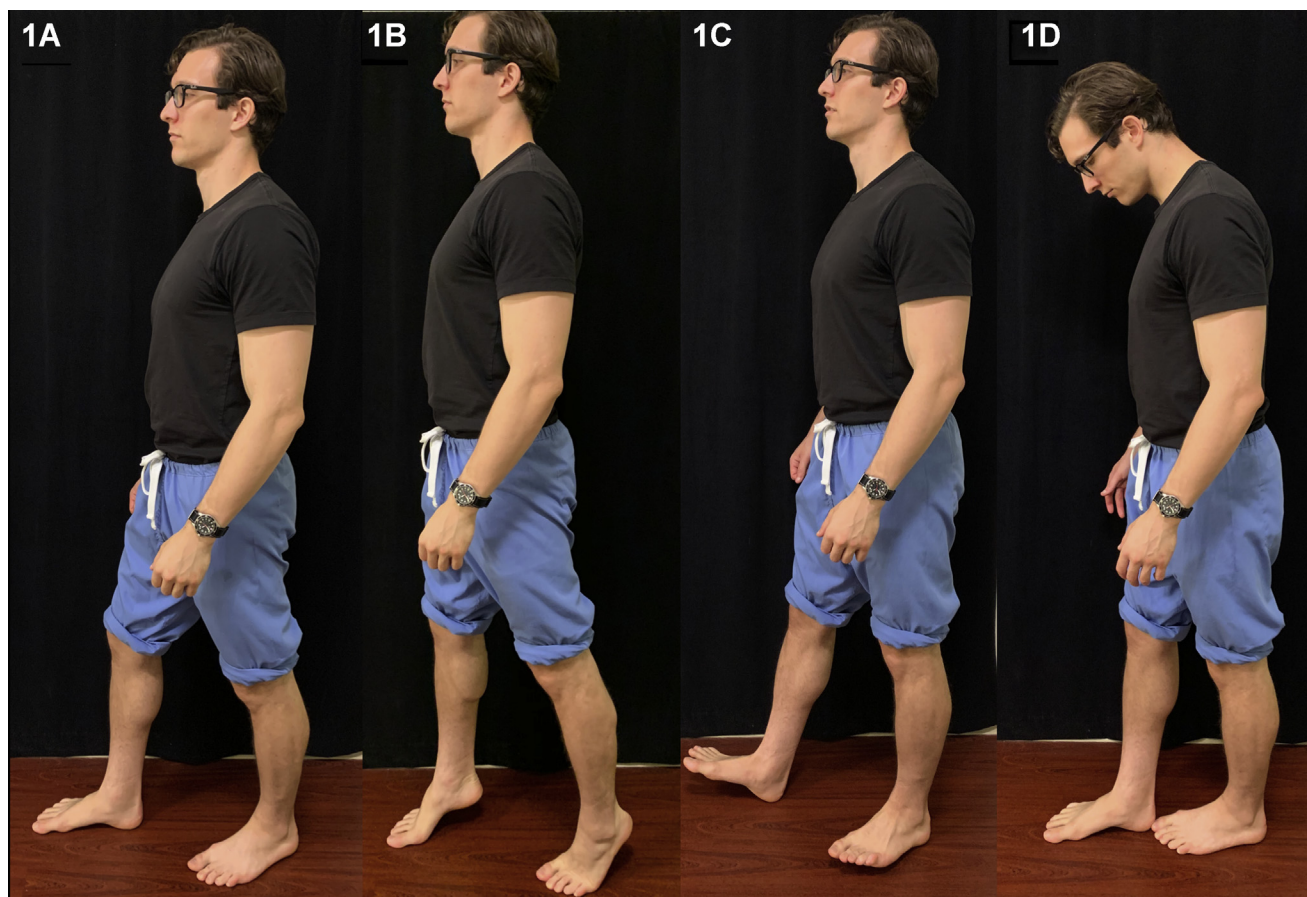


Figure 7. Lower extremity motor examination, continued: (1A) demonstration of regular ambulation; (1B) walking on toes, gastrocnemius and soleus (S1, S2); (1C) walking on heels, tibialis anterior (L4, L5); (1D) tandem gait to assess balance.

examinations would be the next natural step to validate this virtual examination. Studies could also be performed to compare diagnoses from telehealth spine examinations and advanced imaging studies.

CONCLUSIONS

The COVID-19 pandemic has led to a surge in the use of telehealth across the United States. We provide guidelines based on our current practices for providers and patients with non-urgent conditions to work together to create an

efficient and detailed telehealth examination in 5–7 minutes.

CRedit AUTHORSHIP CONTRIBUTION STATEMENT

Zeeshan M. Sardar: Conceptualization, Supervision, Methodology, Writing – review & editing. **Josephine R. Coury:** Writing – original draft, Data curation. **Andrew J. Luzzi:** Writing – original draft, Data curation. **Mark Weidenbaum:** Supervision, Methodology, Writing – review & editing. **K. Daniel Riew:** Supervision, Writing – review & editing.

Table 5. Special Examination Maneuvers

Neurologic Assessment	Instruction to Patient
Lumbar radiculopathy	While laying on your back, lift your leg straight up in the air, does this cause a shooting pain down your leg?
Balance	Walk back and forth with a tandem gait, meaning heel to toe and heel to toe.
Romberg	Stand facing the camera, fold your hands in front of you, have your assistant stand behind you for safety, and close your eyes.
Greater trochanter bursitis	Feel the other side of your upper thighs, you should be able to palpate a bump. Does it hurt when you press in this area?

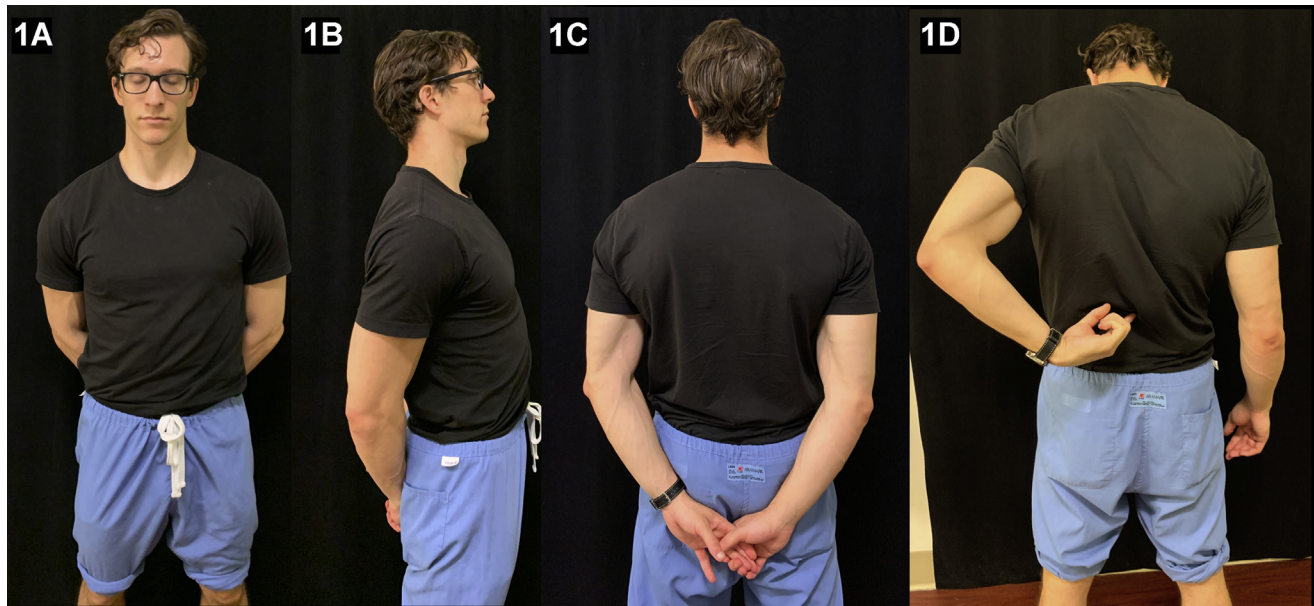


Figure 8. Assessment of posture: **(1A)** anterior to assess shoulder and chest symmetry; **(1B)** to assess for lordosis and scoliosis; **(1C)** for

appearance of back, also assessing for shoulder and flank asymmetry; **(1D)** patient pointing to where their pain is.



Figure 9. Special maneuvers: **(1)** wide-based stance; **(2)** squat to assess strength and balance; **(3)** Romberg test, ideally performed with support from an assistant.

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Conflict of interest statement: The authors declare that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received 3 February 2021; accepted 24 June 2021

*Citation: World Neurosurg. (2021) 154:e61-e71.
<https://doi.org/10.1016/j.wneu.2021.06.116>*

Journal homepage: www.journals.elsevier.com/world-neurosurgery

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APPENDIX A

TELEHEALTH EXAMINATION CHECKLIST

1. Cervical Spine Examination	
Neurologic Assessment	Instruction to Patient
Cervical spine range of motion	Turn your head from side to side, then touch your chin to your chest, and finally extend your neck all the way back.
Equivalent of Lhermitte's sign	When you touched your chin to your chest, did that cause a shock like sensation down your arms/legs?
Equivalent of Spurling's sign	Extend your neck all the way back and tilt/rotate your head towards the affected side. Did that cause the pain you have been experiencing? Did it reproduce the pain in posterior neck? down your arm?
Examination for pain relief indicating radiculopathy	Next place your hands on your head, does it cause relief of your pain?

2. Sensory and Motor Strength Examination of Upper Extremity	
Neurologic Assessment	Instruction to Patient
Lateral deltoid	Touch the outside, or lateral aspect, of your upper arm.
Dorsum of thumb	Touch the backside, or dorsal surface, of your thumb.
Dorsum of middle finger	Touch the backside, or dorsal surface, of your middle finger.
Dorsum of small finger	Touch the backside, or dorsal surface, of your small finger.
Medial elbow	Touch the inner aspect, or medial side, of your elbow.
Shoulder abduction and flexion	Raise your arm to the side and then above your head.
Elbow flexion	Bend your arm at the elbow.
Wrist extension	With your palm facing down, bend your wrist back towards your face.
Wrist flexion	Turn your wrist with the palm facing up, then bend your wrist towards your face.
Elbow extension	Turn to the side, tuck your elbows in and back, then straighten your elbow.
Finger abduction	Place a rubber band around your fingers and spread them.
Finger flexion	Grip pen a pen in your hand making a fist and attempt to remove it with your other hand.
Finger adduction	Pinch a piece of paper between your small and ring finger and attempt to remove it with your other hand.
Finger opposition	Pinch a piece of paper between your small finger and thumb and attempt to remove it with your other hand.

3. Sensory and Motor Strength Examination of Lower Extremity	
Neurologic Assessment	Instruction to Patient
Medial upper thigh	Touch the inner, or medial, aspect of your upper thigh.
Medial knee	Touch the inner, or medial, aspect of your knee.
Medial ankle	Touch the inner, or medial, aspect of your ankle.
Dorsum of 1 st webspace	Touch the top, or dorsum, aspect of the space between your first and second toe.
Lateral heel	Touch the outer, or lateral, aspect of your ankle.
Hip flexion (L2, L3)	While sitting, bend your knee to your chest. [Also tested when patient is asked to perform a squat.]
Knee extension (L3,L4)	Extend your knee so your leg is straight. [Also tested when patient is asked to perform a squat.]
Big toe extension (L5, S1)	Lift your big toe up from the ground and push down with one finger, try to resist the pressure from your finger. [Compare the 2 sides to check for a difference.]
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