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Tetraplegia After Thyroidectomy in a Patient with Cervical Spondylosis

A Case Report and Literature Review

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Abstract: Cervical spondylosis is degeneration of the cervical spine that occurs during the normal course of aging, and may progress into compression of the spinal cord, or cervical spondylotic myelopathy (CSM), which can cause neurologic dysfunction. Cervical spondylosis can be identified in the majority of people older than 50 years. Many people with cervical spondylosis or CSM are asymptomatic. However, patients with CSM are at higher risk of spinal cord injury (SCI) following minor injury.

A 60-year-old woman with asymptomatic cervical spondylosis underwent an elective subtotal thyroidectomy for thyroid nodules. After the surgery, she developed tetraplegia. MRI revealed spinal cord compression and injury. Main diagnoses, therapeutics interventions, and outcomes: Acute cervical SCI was diagnosed. After an emergency anterior cervical corpectomy and fusion surgery, she almost completely recovered.

Iatrogenic cervical SCI after nonspinal surgeries that requires neck hyperextension is rarely reported, probably due to underdiagnosis and underreport. Among the 14 cases (including ours) published in the literature, most patients had cervical spondylosis and were senior men. Five patients had diabetes. Four patients had long-term hemodialysis. Seven patients had undergone coronary artery bypass surgery that requires prolonged operative time. Only 3 patients had almost complete recovery. Most patients were disabled. Two patients required tracheostomy for long-term ventilator support. Two patients died. These cases reiterate the potential risk of iatrogenic SCI in people with predisposing conditions such as cervical spondylosis, especially considering the rising prevalence and severity of cervical spondylosis caused by the aging of the population and modern sedentary lifestyle. Surgeries requiring prolonged neck hyperextension put patients with cervical spondylosis at risk for SCI. Failure to recognize the potential occurrence of iatrogenic SCI might endanger patients' lives.

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Abbreviations: ACCF = anterior cervical corpectomy and fusion, CABG = coronary artery bypass surgery, CSM = cervical spondylotic myelopathy, KFS = Klippel–Feil syndrome, MRC = Medical Research Council, MRI = magnetic resonance imaging, POD = postoperative day, SCI = spinal cord injury.

INTRODUCTION

Cervical spondylosis is degeneration of the cervical spine that occurs during the normal course of aging. This degeneration leads to herniated intervertebral discs, osteophytes, and ligament hypertrophy, which may eventually cause compression of the nerve roots and spinal cord. Spinal cord compression, or cervical spondylotic myelopathy (CSM), can cause symptoms including gait imbalance or ambulatory difficulty, loss of fine control of the hands, sensory disturbances, and urinary difficulties. Many people with CSM are asymptomatic or have only mild symptoms; diagnosis frequently results from incidental findings on x-ray or MRI. In a study of asymptomatic volunteers, cervical intervertebral disc protrusion with spinal cord compression was observed in 7.6% of people, with a higher prevalence in seniors.[1] This lack of symptoms is clinically significant, as patients with CSM are at higher risk of spinal cord injury (SCI) following minor injury.[2]

CASE PRESENTATION

A 60-year-old woman visited her physician complaining of mild neck pain for the previous 3 months. She had normal muscle strength and no neurologic symptoms. A cervical spine x-ray demonstrated degenerative spondylosis and congenital fusion of C2 and C3 vertebrae (Figure 1A). MRI was deemed unnecessary, and she was treated with physical therapy, which eased the pain. One month later, she was found to have asymptomatic thyroid nodules during a routine medical examination. Ultrasonography, fine needle aspiration and CT scan could not rule out thyroid cancer. Therefore, subtotal thyroidectomy was performed under general anesthesia and completed uneventfully in about 100 minutes. She later became incompletely paralyzed, with muscle strength of the lower and upper limbs of grades 1/5 and 2/5, respectively, according to the Medical Research Council (MRC) scale. MRI revealed intervertebral disc herniation with spinal cord compression and injury (Figure 1B). She was immediately transferred to our spinal surgery center, and an emergency anterior cervical corpectomy and fusion (ACCF) was performed about 24 hours after thyroidectomy. Following surgery, the patient's motor

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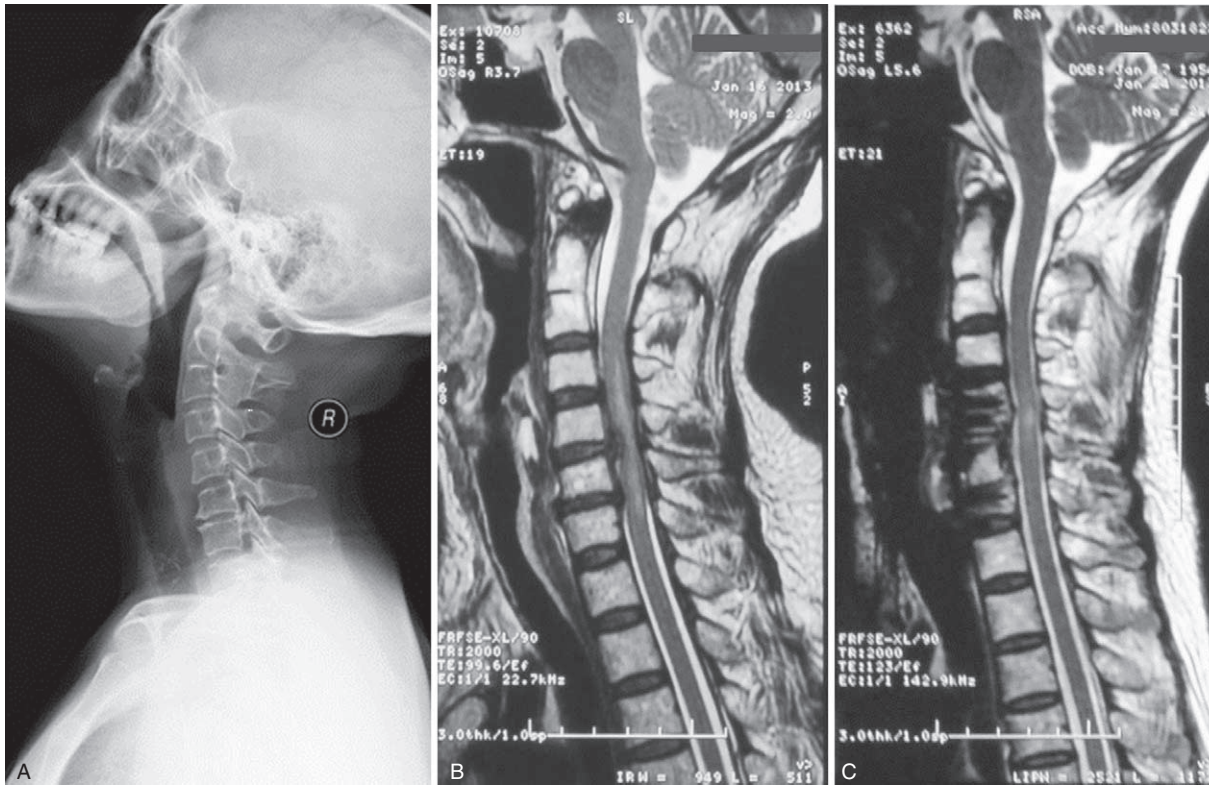

FIGURE 1. (A) Plain x-ray taken 1 month prior to surgery showing fusion of C2–C3, osteophyte formation, and decreased height of the intervertebral space at C6–C7. (B) Sagittal T2-weighted MRI performed 1 day after thyroidectomy showing herniation of C5–C6 and C6–C7 intervertebral discs causing compression of the spinal cord, and increased signal intensity of the spinal cord from C4 to C7 indicating cord injury. (C) Sagittal T2-weighted MRI 1 week after spinal surgery (C5–C6, C6–C7 discectomies, C7 subtotal corpectomy and fusion) showing excellent spinal cord decompression.

function improved dramatically: She regained the ability to walk 3 days later, and her muscle strength returned to grade 4/5 within 1 week and grade 5/5 within 3 months, with only slight numbness in her left index finger. One week after the spinal surgery MRI showed excellent spinal cord decompression (Figure 1C).

DISCUSSION

In our case, a preoperative cervical spine x-ray suggested congenital fusion of C2 and C3 vertebrae, spondylosis, and C6–C7 disc disease judging from the decreased height of the intervertebral space (Figure 1A). Congenital fusion of 2 or more cervical vertebrae is known as Klippel–Feil syndrome (KFS), a condition with an estimated incidence of 1 in 40,000 newborns.[3] Classical signs of KFS include short neck, low hairline, and decreased range of motion of the neck, but about half of patients including ours do not have these features. Asymptomatic patients are nonetheless at higher risk of developing degenerative cervical myelopathy or cervical SCI following a minor traumatic episode.[3] In our patient, the C2–C3 fusion might have promoted the development of chronic cervical spondylosis. The patient had a history of mild neck pain, whether she had spinal cord compression before thyroidectomy is not known. During the thyroidectomy, the spinal canal become narrower due to neck extension.[4] Moreover, neck hyperextension might squeeze the disc posteriorly, causing compression and injury of the spinal cord.

Comorbid conditions such as cervical spondylosis, tumors in the cervical spinal canal, or atlanto-axial subluxation predispose patients to SCI by causing spinal stenosis or instability. Procedures including thyroidectomy, parathyroidectomy, dental extraction, and coronary artery bypass require prolonged neck hyperextension, which might cause compression of the spinal cord and anterior spinal artery by herniated discs, osteophyte, thickened ligaments, or spinal tumors (Table 1). Tetraplegia following these procedures is rarely reported, probably due to underdiagnosis and underreport. The consequences are catastrophic, often leaving patients completely disabled (Table 1).[6,12] Among the 14 cases we found in the literature and summarized in Table 1 (2 cases had incomplete data), most patients had cervical spondylosis (9/14, 64.3%), were seniors (60 years or older, 8/12, 66.7%), and were men (12/13, 92.3%); only our patient was woman. Five patients had diabetes (5/12, 41.7%), and 4 patients had undergone long-term hemodialysis for end-stage renal disease (4/12, 33.3%). Long-term hemodialysis can cause extradural amyloid deposition and thickening of the posterior longitudinal ligament, leading to cervical spondylosis and spinal cord compression.[6,12] Seven patients (7/14, 50%) had undergone coronary artery bypass surgery (CABG), which requires several hours to complete, so the prolonged operation may have contributed to their SCI; among them, 6 patients had hypertension (6/7, 85.7%), suggesting that hypertension might also be a risk factor for post-CABG SCI. Only 3 patients had almost complete recovery (3/13, 23.1%). Most patients were disabled (10/13, 76.9%). Two patients required

TABLE 1. Summarization of Similar Cases (Iatrogenic Tetraplegia Caused by Cervical Spinal Cord Compression After Nonspinal Surgeries Requiring Neck Hyperextension)

Age/ Gender	(Potential) Predisposing Factors	Procedure /Duration	Neurologic Deficit	Treatment	Outcome	Reference
65/M	Congenital short pedicles, noninsulin-dependent diabetes, hypertension, and hyperlipidemia	Coronary artery bypass surgery (CABG) / (bypass time) 90 min.	Incomplete Tetraplegia Motor strength: impaired in distal upper limbs, lower limbs: 0 / 5	Anterior cervical decompression (time not revealed)	No improvement	Clancy et al 2014[5]
77/M	Cervical spondylosis, diabetes, hypertension, chronic hepatitis B, and 6-year hemodialysis for end-stage renal disease	CABG, 6 h	Incomplete tetraplegia, upper limbs: 2–3/ 5 motor strength; lower limbs: 1/ 5 motor strength	C3–C6 laminectomies on POD 5, anterior decompression with C4–C7 discectomies on POD 10	No improvement, tracheostomy for ventilator support and died of pneumonia 6 mo later	Li et al 2013[6]
62/M	Numbness in both arms indicating possible cervical disc herniation, hypertension	CABG / duration not revealed	Tetraplegia, 0–1/ 5 motor strength	Decompression on POD 2	Improved significantly. Strength: 3–4/5	Gorur et al 2010[7]
63/M	Cervical spondylosis (asymptomatic), diabetes mellitus, hypertension, gout, peptic ulcer disease, and renal dysfunction	CABG / (bypass time) 129 min.	Tetraplegia, 0–1/ 5 motor strength	Steroid therapy, dexamethasone, 4 mg, every 8 h	Almost completely recovered at 6 mo after the event	Hwang et al 2008[8]
61/M	Undiagnosed cervical stenosis	CABG / 4 h	Complete tetraplegia	Emergency anterior cervical decompression (time not)	Improved. 3 mo later died from bowel perforation and respiratory failure	Naja et al 2005[9]
63/M	Spinal canal stenosis, hemodialysis for diabetic nephropathy, diabetes, hypertension.	CABG / 6 h	Incomplete tetraplegia, 1–2 / 5 motor strength. Frankel Grade B	Edaravone (a radical scavenger) and rehabilitation	Improved Strength, upper limbs: 2–4 / 5, lower limbs: 1 / 5. Frankel Grade C	Fujioka et al 2003[10]
65/M	Diabetes, hypertension, peripheral vascular disease, and previous stroke. Denied neck pain or muscle weakness	Urgent CABG / duration not revealed	Complete loss of motor and sensory function below T1, upper extremity weakness, and difficulty of breathing	Hydrocortisone therapy Anterior cervical corpectomy and fusion (ACCF) at least 2 days after CABG	No improvement, tracheostomy for long-term mechanical ventilator support	Hirose et al 2003[11]
60/F	Degenerative spondylosis and congenital fusion of C2 and C3 vertebrae	Subtotal thyroidectomy/100 min	Incomplete tetraplegia Motor strength, upper limbs: 2/ 5; lower limbs: 1/ 5	Anterior cervical corpectomy and fusion (ACCF) on POD 2	Completely recovered	Our case
42/M	Hypertension, undiagnosed spinal meningioma	Thyroidectomy / 90 min	Tetraplegia below C4 level, Frankel Grade A	Rehabilitation	No improvement Tracheostomy performed on fifth POD Breathe spontaneously from the 14th POD	Carron et al 2010[12]

Age/ Gender	(Potential) Predisposing Factors	Procedure /Duration	Neurologic Deficit	Treatment	Outcome	Reference
54/M	Possible cervical disc herniation, thickening of the posterior longitudinal ligament, 27-year history of hemodialysis for chronic glomerulonephritis	Subtotal parathyroidectomy / 5 h	Tetraplegia (motor strength 0–1/5)	ACCF	Modest improvement	Mercieri et al 2009[13]
47/M	Pain around shoulders, hips, and lumbar spine, thickening of the posterior longitudinal ligament, 26 years of hemodialysis for chronic IgA glomerulonephritis	Total parathyroidectomy / 4 h	Moderate tetraplegia (motor strength 2–3/5)	ACCF	No improvement	Mercieri et al 2009[13]
NA*	Possible cervical disc herniation	Stapedectomy for otosclerosis	Tetraplegia acutely herniated disk at C6–C7	NA	Strength, upper limbs: 4–5/5, lower limbs: 0–1/5	Tomás et al 2000[14]
7/M	Atlanto-axial subluxation causing muscle wasting and weakness of all 4 limbs, hyperreflexia, and bilateral extensor plantar responses (ignored preoperatively)	Adenotonsillectomy 40 min	Inadequate respiratory and neuromuscular function	Posterior approach cervical spine fixation surgery	Slow but complete recovery over 7 mo	Agarwal et al 2013[15]
M†	Advanced spondylosis and spinal stenosis	Dental extraction	NA	NA	NA	Whiteson et al 1997[16]

ACCF = anterior cervical corpectomy and fusion, CABG = coronary artery bypass surgery, Frankel Grade B = sensory function only below the injury level, Frankel Grade C = incomplete motor function below injury level, NA = information not available, POD = postoperative day.

* Article in Spanish, full text is not available.

† Full text is not available.

tracheostomy for long-term ventilator support (2/13, 15.4%). Two patients died during short-term follow-up. In the case described by Li et al,[6] a patient with asymptomatic cervical spondylosis and renal disease requiring long-term hemodialysis developed quadriplegia after CABG, and surgeries to decompress the spinal cord posteriorly and anteriorly performed 5 and 10 days after the iatrogenic quadriplegia, respectively, did not lead to clinical improvement. The patient received mechanical ventilator support and eventually died of pneumonia 6 months later. In another case, tetraplegia following thyroidectomy in a patient with spinal meningioma was not correctable by immediate decompressive laminectomy.[12] Fortunately, our patient had localized injury of the spinal cord and received prompt treatment, allowing an almost complete recovery.

Cervical spondylosis can be identified in the majority of seniors. In a recent study, CSM was observed in 7.6% of asymptomatic volunteers, with a higher prevalence in seniors,[1] underlining the necessity to raise awareness of this severe complication. We believe a detailed evaluation for signs of cervical spondylosis and CSM should be mandatory for male senior patients prior to any surgery requiring prolonged neck hyperextension especially CABG. This evaluation is especially important in patients with comorbidities including diabetes, long-term hemodialysis, or hypertension. Preoperative cervical MRI might be justified in high-risk patients. Moreover, modifying surgery to decrease the degree and duration of neck extension might be helpful to reduce the risk of SCI.

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