

The Natural History and Management of Cervical Spondylotic Myelopathy



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Abstract

Cervical spondylotic myelopathy results from degenerative changes in the cervical spine and its associated soft tissues. The pathology starts in the intervertebral disc before involving other anatomical sites in the cervical spine and soft tissue. Subsequent pathoanatomy may lead to alterations in biomechanics, stability and neurological function. The natural history is highly variable and there has been differing views on the indications and timing of surgery as well as the surgical approaches. This article reviews the literature on these issues and gives the rationale for the current opinions in management.

Keywords: Myelopathy; Cervical; Spondylosis

Abbreviation: CSM: Cervical Spondylotic Myelopathy

Introduction

Devising a surgical protocol for cervical spondylotic myelopathy (CSM) is adversely influenced by the diversity in clinical and radiological presentation [1]. A variety of surgical approaches are used to treat CSM including anterior, posterior or combined decompression with or without fusion [2,3]. The goals of the varying surgical techniques are to prevent deterioration, or in some cases to reverse myelopathy by:

- i. Decompressing the spinal cord
- ii. Improving cord perfusion
- iii. Stabilising the spine [4].

Discussion

Cervical spondylotic myelopathy (CSM) is a consequence of degenerative changes in the cervical spine and associated soft tissue structures [3,5]. Degeneration is a natural consequence of aging in the vast majority of the population [4,6]. Aging results in an alteration in the chemical composition of the annulus fibrosus and nucleus pulposus [7]. This leads to disc height loss, motion abnormalities and uncovertebral and facet joint arthrosis [3,6,7] resulting in an alteration of the biomechanics, stability and neurological function of the spine [6]. Spinal cord compromise, secondary to degenerative disc disease occurs most commonly at C5/6, followed by C6/7 then C4/5 [6,8,9]. Osteophytes may

cause spinal cord and or nerve root compression [3,6], however neurological symptoms secondary to cervical spondylosis, occur from a cascade of degenerative changes which likely originate at the intervertebral disc [7]. Facet arthrosis and ligament redundancy may cause dorsal compression. Spondylosis causes circumferential narrowing of the spinal canal and static compression of the cord. Dynamic compression is via ligamentum flavum buckling in extension and impingement from a disc or osteophyte in flexion [3,6,7,9,10].

In symptomatic cases, a simplified clinical approach divides cervical spondylosis into axial neck pain, radiculopathy, myelopathy or a combination of these [6,7,10]. CSM is the manifestation of long tract signs due to a decrease in the space available for the cord [7,10]. It is one of the leading causes of spinal cord dysfunction in adults and represents a large proportion of patients who undergo operative management of degenerative cervical conditions [4].

Early diagnosis is challenging because of subtle clinical findings [4]. Patients present with motor and sensory disturbances of variable type and intensity [3,8,10]. Diagnosis requires a high index of suspicion because of this subtle and variable presentation [7]. Patients or their relatives may note awkwardness in gait or difficulty with balance which they often attribute to old age [4]. Disturbances in the corticospinal and spinocerebellar tracts lead

to early lower extremity findings of ataxia, spasticity and paresis. Upper extremity symptoms develop, in the form of weakness [4] or decreased fine motor skills [3,4]. With further progression, sphincter problems develop [3]. Clinically upper motor neuron findings occur in the lower limbs and lower motor neuron findings occur in the upper limbs at the level of the compression [8].

Cheung et al. [5] found that surgery effectively relieved upper limb, lower limb and sphincter symptoms. Abnormal reflex findings include hyperreflexia or clonus, loss of superficial reflexes or presence of pathological reflexes [10]. Studies of the natural history of CSM suggests that the majority of clinically established disease will likely have symptomatic progression in a step wise fashion with time including worsening gait abnormalities, weakness, sensory changes [11] and often pain [3,12]. The natural history is important because without this knowledge, one cannot place treatment, conservative or operative, into proper perspective [13,14]. Lees & Turner [14] found that the disease course may be prolonged and long periods of non-progressive disability are the rule. They also noted that a progressive deteriorating course is exceptional.

Lees & Turner [14] felt it was difficult to assess the effects of conservative management versus surgery in a condition they viewed as benign and felt treatment may not alter the natural history. Rao et al. [4] states however that true natural history studies are unavailable. The true natural history may be difficult to determine because in the majority of patients, symptoms are attributed to other neurologic conditions or age [7]. Due to this variable natural history, surgical recommendations ought to be based on each individual's history [11,13]. Surgery must therefore be considered in most patients because of the risk of clinical deterioration [4]. A standard treatment algorithm is difficult to formulate because of the variable initial presentation and subsequent course of the disease and the lack of prospective randomised studies which stratify treatment options for patients with varying severity of myelopathy [1,4,8,13]. Holly et al. [15] noted that many advocate decompressive surgery because they believe that the natural history is a progressive, stepwise neurologic decline. Surgery may make the patient better, worse or the same but the complication rates are low [15].

Risk factors for poor prognosis are moderate disability on presentation and long duration of symptoms. Unfortunately no natural history study has been able to determine reliable prognostic factor indicators for progression or resolution [13,16]. It has been suggested that space available for the spinal cord is the most important factor [6]. The anteroposterior diameter of the sub axial spine is 17 to 18 mm in a normal adult. The diameter of the cord in this area is 10 mm. An anteroposterior diameter in this area less than 13 mm is considered to be congenital cervical stenosis [7].

Flattening of the cord within a narrowed spinal canal is strongly associated with cervical myelopathy [7]. Measurement of the transverse area of the cord at the affected level on post myelographic

CT is the most accurate predictor of neurologic recovery of CSM [8,17]. Patients with less than 40% compression and myelopathy, most likely have additional factors e.g. developmentally decreased anteroposterior diameter of the canal [16]. Nurick [18] and Emery et al. [19] found that cord compression was the important factor and that the worse the compression, the worse the paresis. Other factors considered when deciding on operative intervention include patient disability, degree of neurologic dysfunction, findings on radiographs and magnetic resonance imaging, duration of symptoms and presence of comorbidity [10,20].

Surgical prognostic factors are still controversial [5]. There is conflicting class 2 evidence on age; however this same evidence does suggest that duration of symptoms, stenotic activity, myelopathic severity and poorly controlled diabetes are negative risk factors [21]. Cheung et al. [5] found that age, gender and duration of symptoms were not prognostic factors, whereas Rao et al. [4] found that good surgical prognostic factors include younger age, lack of co-morbidities and surgery earlier in the course of the disease. Yamazaki et al [17] felt that a shorter duration of symptoms was an important factor in the excellent recovery of elderly patients. Cheung et al. [5] found that upper limb recovery was greater than lower limb which was greater than sphincter function following anterior or posterior surgery.

No other area of spinal surgery has been subject to as much diversity in surgical approaches [11]. The management of CSM is controversial [1,9,15]. Sampath et al. [22] compared patients with CSM treated conservatively versus surgically. Despite having the greater number of worse neurological symptoms and worse functional disability before treatment, the surgically treated patients had better outcomes. The absolute indications for surgery are progression of neurological deficit [3,9,13] or the failure of neurological findings to improve with nonoperative management especially if the duration of symptoms are six months or more [9,23]. Geck & Eismont [16] stated that surgical indications should be tailored to the patients' baseline function, symptoms, rate of decline and medical status. For patients with nonprogressive disease, there are no clear established guidelines with respect to surgical indications [4]. When Kadanka et al. [13] prospectively compared surgical treatment for patients with mild disease; there was no significant difference in outcome. Aims of surgery include spinal cord decompression while maintaining the stability and sagittal alignment of the cervical spine [2,8].

Good surgical decompression may be achieved anteriorly or posteriorly [19,24]. The choice of the surgical approach are based on factors including location of compression, longitudinal extent of disease, alignment of spinal canal, dimension of spinal canal, previous surgery, and preoperative axial neck pain [4]. Surgical options include laminectomy, laminoplasty, discectomy and corpectomy with or without stabilisation [25]. The inability to demonstrate superiority of one procedure over the other creates a dilemma in choosing an ideal procedure for an individual patient [1]. Choosing the right patient for a surgical procedure is

as important as the expert performing the surgical technique [26]. Until the 1960's, posterior decompression was the gold standard for the surgical management of CSM. Since the advent of anterior surgery for multilevel disease, there were numerous arguments with respect to the most superior surgical intervention [1,3]. Due to the improved technology, anterior decompression has increased in popularity as it allows direct decompression and reconstruction with complication rates comparable to posterior surgery [1].

Recent long-term outcome and review studies [27,28] have suggested that either anterior or posterior decompressive techniques have similar results with different disadvantages. Holly et al. [15] in performing a systematic review of the literature on the use of clinical predictive factors on surgical outcomes in patients undergoing surgery between 1966 and 2007, found 14 relevant articles. Several limitations in the current literature included a lack of validated outcome measures which prevented from the analysis of surgical outcomes from individual studies or doing inter-study comparisons. They found that several studies performed a single surgical procedure which biases the clinical outcome and the determination of the duration of symptoms were unclear. The definition of elderly was also unclear in many studies. They concluded that age, symptom duration and preoperative neurological function should all be discussed with any patient undergoing surgery.

Conclusion

Due to the varying clinical courses of CSM, the decision for surgery should be individualized. Surgical indications should be based on the severity and chronicity of symptoms, baseline function and rate of deterioration.

Conflict of Interest

Nil economic or conflict of interests.

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