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Cervical Kyphosis

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Cervical kyphosis is a rare condition that can cause significant functional disability and myelopathy. Deciding the appropriate treatment for such deformities is challenging for the surgeon. Patients often present with axial neck pain, and it is not uncommon to find coexisting radiculopathy or myelopathy. The optimal approach for addressing this complex issue remains controversial. A comprehensive surgical plan based on knowledge of the pathology and biomechanics is important for kyphosis correction. Here we reviewed diagnoses of the cervical spine along with the literature pertaining to various approaches and management of cervical spine.

Keywords: Cervical spine; Kyphosis; Deformity

Introduction

The cervical spine supports the mass of the cranium, while permitting a wide range of motion compared with the thoracic and lumbar spine. It also protects important neurovascular structures such as the spinal cord, nerve roots, and vertebral arteries. Besides these basic functions, the cervical spine plays a pivotal role in maintaining the horizontal gaze of an individual. Cervical kyphosis is the most common deformity that affects the cervical spine by altering the its normal function, leaving the patient significantly disabled [1]. Cervical kyphosis can be either regional or global, and has been shown to be associated with reduced quality of life [2]. Managing cervical kyphosis is challenging for the spinal surgeon, and setting realistic surgical goals and meticulous preoperative planning can achieve the optimal clinical outcomes, while managing the condition. In this review, we highlight preoperative planning and management principles involved in the treatment of cervical kyphosis.

Radiographic Evaluation

Preoperative planning for surgical treatment of the cervical spine begins with assessing the plain and dynamic radiographs of the cervical spine. Various parameters used to assess cervical spine include cervical lordosis (CL), chin to brow vertical angle (CBVA), C2–C7 sagittal vertical axis (C2–C7 SVA), T1 slope (T1S), neck tilt, and thoracic inlet angle (TIA) [3-5]. Fig. 1 shows these parameters measured using plain X-ray. Advanced radiological investigations such as computed tomography (CT) myelogram and/or magnetic resonance imaging (MRI) are useful to determine the compression of the spinal cord. MRI also aids the assessment of the intervertebral discs, presence of scar tissue, and posttraumatic integrity of the posterior ligamentous complex.

1. Cervical lordosis

The Cobb angle is the simplest and most commonly used method to determine CL. Other methods include the

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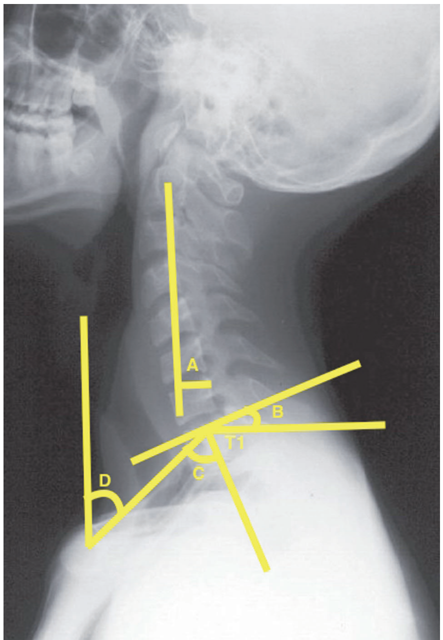

Fig. 1. Parameters measured using plain X-ray. a: C2–C7 sagittal vertical axis; b: T1 slope; c: thoracic inlet angle; and d: neck tilt.

Jackson physiological stress line method and Harrison posterior tangent method [1,6,7]. The Cobb angle can be calculated using either C1–C7 or C2–C7. The former tends to overestimate lordosis, while the latter tends to underestimate it. This has led to the notion that Harrison tangent method is the most accurate method for measuring CL [3]. It is important to understand segmental lordosis, as each segment in the cervical spine has a different focal alignment. The C1–C2 segment contributes to 70% to 80% of CL [7]. A maximum of only 6° of CL is present between C4 and C7 [8]. In a study of 200 asymptomatic individuals aged 20–65 years, Gore et al. [9] demonstrated that males had an average lordosis of 16°–27° and females had average lordosis of 15°–25°. The least lordosis was seen in 20–25-year-olds in both sexes.

2. C2–C7 sagittal vertical axis

C2–C7 SVA is the distance of the postero-superior aspect of the C7 vertebral body from the C2 plumb line. In an asymptomatic individual, the average C2–C7 SVA is 16.8±11.2 mm [10]. Tang et al. [2] reported that C2–C7 SVA >40 mm after cervical fusion is associated with a significantly poor score for neck disability index compared with C2–C7 SVA <40 mm.

3. Chin to brow vertical angle

CBVA is measured using the angle subtended between a line drawn connecting the patient's chin and brow, using a vertical line on a photograph with the patient standing with his hips and knees extended and the cervical spine in a neutral position [4]. It is an indirect measure of the ability of a patient to maintain a horizontal gaze and is significantly correlated with quality of life [4]. The aim of corrective surgeries is to restore CBVA as near as possible to the normal [4].

4. T1 slope, thoracic inlet angle, and neck tilt

T1S is analogous to sacral slope and is defined as the angle subtended by the T1 upper end plate and the horizontal plane. TIA is analogous to pelvic incidence and is defined as the angle between the line connecting the sternum and the midpoint of the superior end plate of T1 and the line perpendicular to superior end plate of T1 [5]. Although it can be measured using X-ray, CT provides a more accurate measurement of TIA. Lee et al. [5] stated that TIA is a fixed parameter, as the thoracic inlet is immobile due to the articulations between the sternum, first rib, and T1 body. However, in a series of 52 patients, Janusz et al. [11] found that TIA varied by at least +10 cm compared with C7–S1 SVA. The authors concluded that T1S was a useful parameter to evaluate the overall sagittal alignment. Neck tilt is similar to pelvic tilt, and is defined as the angle between the line connecting the sternum to the midpoint of the superior end plate of T1 and the vertical axis. Janusz et al. [11] suggested that neck tilt outside beyond 13°–25° should be evaluated for overall sagittal imbalance.

Preoperative Planning

The first step in appropriate preoperative planning is to understand the underlying cause and the magnitude of the deformity. It is imperative to know that cervical kyphosis in the subaxial spine is associated with compensatory hyperlordosis at the cervico–occipital junction. This is important in planning cranio–cervical fusion. The main goals of cervical kyphosis surgery are: (1) to restore subaxial CL to 15°, thus improving the spinal alignment and balance; (2) to decompress the spinal cord and nerve roots; (3) to restore C2–C7 SVA to <40 mm; (4) to restore the horizontal gaze of vision; (5) to attempt to normalize the T1S; and (6) to achieve good fusion to reduce neck pain [12]. The type of approach (anterior, posterior, or combined) is decided using MRI and/or CT myelogram, depending upon the severity and location of the neurological compression. It is also useful to determine the extent of adequate neurological decompression [12]. The most important and critical factor to determine the type of surgery (anterior, posterior, or combined) is the flexibility of the deformity [12,13]. Dynamic radiographs help to determine the ability of deformity correction by altering the position, while a CT scan provides additional information about bony ankylosis at disc space and facet joints.

1. Management principles

As described previously, the broad focus of the treatment of cervical spine deformity correction is to relieve pain, improve alignment of neck, and improve or prevent neurological compromise. Factors that play a key role in the planning of treatment include the presence of spinal cord compression, the flexibility of the deformity, previous surgery, the location of the deformity, and the presence of preexisting anterior or posterior fusion [14].

If the compression is ventral to the spinal cord then it usually requires anterior decompression unless the decompression can be achieved safely by indirect means by deformity correction through a posterior approach (that requires posterior closing wedge osteotomy) [15]. If the anterior column is deficient (either due to infection or tumor), anterior fixation is almost always required [16]. Depending upon the flexibility of deformity, the approach can be planned. If the deformity is flexible and the surgeon is able to achieve the adequate neck extension by manipulation, then an entirely posterior approach can be used for deformity correction [17]. In cases of stiff deformity, fusion of facet joints should be evaluated using CT before deciding further treatment. However, it is imperative to apply cervical traction for a brief period if the desired extension is not achieved or is partially achieved, and if the facet joints are not ankylosed. In practice, the authors applied traction for around seven days before reevaluating the flexibility of deformity. If the surgeon is able to achieve the desired extension, deformity correction can be performed using a posterior approach. Cervical kyphosis is unlikely to improve if no deformity correction is observed after one week of traction [18]. Traction may also be associated with complications such as transient neurological deficits and patient compliance, and is used intraoperatively to aid deformity correction following decompression in anterior surgeries [19]. If the desired extension cannot be achieved, additional anterior

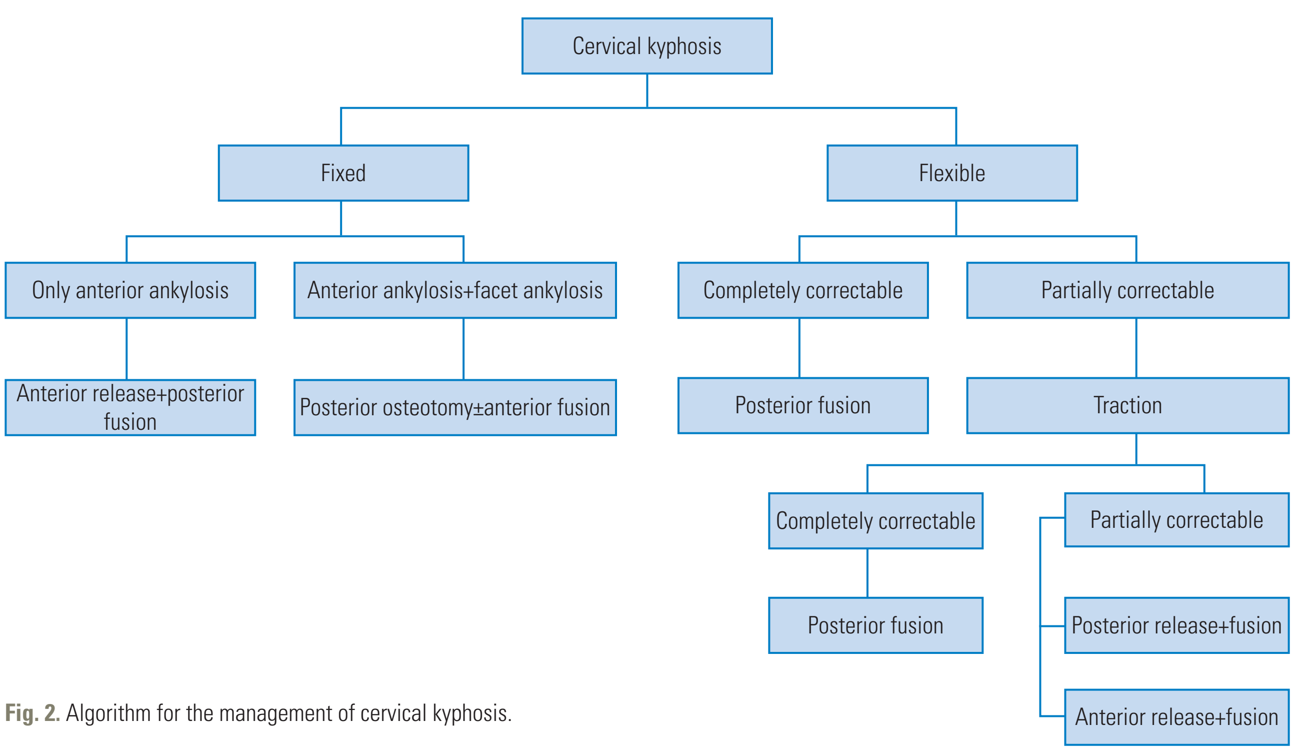

Fig. 2. Algorithm for the management of cervical kyphosis.

release along with posterior instrumentation (if anterior fusion spans more than three levels) may be required.

The location of the deformity also plays an important role in deciding the approach. Focal kyphosis of the cervical spine can be addressed by anterior corpectomy and fusion, while focal kyphosis at the cervicothoracic junction can be managed via posterior pedicle subtraction osteotomy (PSO) at the cervicothoracic junction [14].

In cases with a history of prior cervical spine surgery, every attempt should be made to obtain the surgical notes in order to determine the intraoperative findings and the type of instrumentation used (if any). A CT scan should be performed to evaluate prior fusion or pseudoarthrosis. If an anterior approach was used previously it may be necessary to approach the cervical spine from the contralateral side, as the scar tissue from previous surgery will make the dissection difficult. However, it is mandatory that an otolaryngologist assesses the vocal cords to ensure adequate mobility preoperatively. In cases where the recurrent laryngeal nerve is injured during prior surgery, a same-side approach should be utilized to prevent injury to the bilateral recurrent laryngeal nerve. If a posterior approach was used in a previous surgery, the wound should be inspected to assess the integrity of the muscles and soft tissue. In cases of dehiscence of muscle cover, consultation with a plastic surgeon should be sought to ensure good soft tissue cover before planning revision surgery. Fig. 2 shows an algorithm for the management of cervical kyphosis.

Surgical Considerations

Surgical planning involves calculating the amount of correction required for the radiographic parameters. Although there is no ‘normal’ range described, the current literature recommends that T1S to C2–C7 lordosis should be <15°, C2–C7 SVA should be <40 mm, and an acceptable CBVA is −10 to +20 [20,21].

The magnitude of kyphosis, location of the compression, flexibility of the deformity, presence and location of the bony ankyloses, and history of previous surgery/laminectomy determines the specific surgical approach. Broadly, cervical kyphosis can be classified as fixed or flexible. Flexible deformities usually require realignment surgery, whereas more complex, fixed deformities require surgical correction using a combined (anterior+posterior) approach or osteotomies.

1. Anterior approach

An anterior approach is preferred in patients with a fixed deformity. Anterior techniques rely on restoring segmental lordosis, thus it is crucial to evaluate facet ankylosis using CT. Kyphosis correction with an anterior fusion, and with or without instrumentation, has been described in the literature [18,19,22].

In a retrospective analysis of 14 patients who underwent anterior corpectomy with strut grafting and without instrumentation, Zdeblick and Bohlman [19] reported that at the average follow-up period of 27.9 months, Nurick scores improved from 3.6 (preoperative) to 1.3 (postoperative). No patient had neurological deterioration. The mean preoperative kyphosis was 45°, mean postoperative kyphosis was 13°, and mean kyphosis correction was 32°. The authors reported an average loss of 4° correction at follow-up. Three patients had their bone grafts dislodged in the immediate postoperative period despite immobilization using a halo vest.

In another retrospective study, Zdeblick et al. [23] reported the functional outcome of anterior corpectomy and strut grafting in patients with failed anterior cervical diskectomy and fusion and kyphosis (n=8). Revision surgery was performed with an average duration of 32 months from the index procedure. The average kyphosis correction was 30°. Seven out of eight patients had excellent or good functional outcome; however, poor outcome was reported in one patient. This patient had pseudoarthrosis and recurrence of myelopathy, and underwent revision surgery.

In a series of 18 patients, Riew et al. [22] analyzed 18 patients with postlaminectomy cervical kyphosis that were treated with anterior cervical corpectomy and fusion. The mean kyphosis correction at final follow-up was 6°. Eight out of 18 patients had demonstrated kyphosis correction. The authors also reported an increment in kyphosis by 10° due to the subsidence of strut graft. The major focus of this study was to study the complications associated with this procedure. The authors reported a complication rate of >50% related to surgery alone, including failure of fusion, dislodging or subsidence of the graft, and an increment in kyphosis. They also reported that the halo vest provided insufficient immobilization and was not adequate to prevent complications related to the strut graft.

Following further advances in instrumentation systems, anterior cervical decompression and fusion with plate reconstruction was described as the only anterior procedure for the treatment of cervical kyphosis. Herman and Sonntag [18] retrospectively analyzed 20 patients undergoing anterior cervical corpectomy with fusion and plate fixation for treatment of postlaminectomy kyphosis. The mean preoperative kyphosis was 38°. At a mean follow-up of 28 months, all patients showed an evidence of solid fusion with a mean postop kyphosis of 16°. A mean deformity correction of 20° was achieved with intraoperative traction. The majority of complications in this study were not related to surgical technique, and only one (5%) patient had implant-related complications (screw pulled out).

In a case series of four patients of postlaminectomy kyphosis treated with anterior decompression and fusion with platting, Gulmen and Zileli [24] reported good clinical outcome in three patients, and around 20° of mean improvement in kyphosis. One of the four patients died 20 days after surgery due to respiratory complications.

Ferch et al. [25] retrospectively studied 28 patients undergoing anterior decompression with instrumented fusion for cervical kyphosis. A total of 93% (26/28) of patients were available for analysis. The average follow-up period was 25 months. The mean preoperative local and regional kyphosis was 12 and 10, respectively, and the average local and regional kyphosis correction was 14 and 11, respectively. At final follow-up, the modified Japanese Orthopedic Association (mJOA) scores improved in 11 patients, whereas it remained stable in 15 patients. Deterioration of the mJOA score was reported in one patient. Neck pain scores remained unchanged in the preoperative and postoperative periods.

Steinmetz et al. [26] proposed hybrid surgery for postlaminectomy cervical kyphosis correction. This technique combined corpectomy and discectomy with anterior cervical plate fixation. In a retrospective study of 10 patients, the authors reported improvement in all patients, and three patients reported complete resolution of symptoms. The average preoperative kyphosis was 13.2°, while that at final follow-up was −8.4°. A mean cervical kyphosis correction of 21.6° was observed. However, one limitation of this study was the low duration of follow-up. Three patients experienced complications; one had postoperative dysphagia and two suffered hoarseness of the voice.

In a retrospective study of prospectively collected data, Park et al. [27] analyzed 23 patients undergoing anterior reconstruction surgery using a hybrid technique and plate fixation for postlaminectomy kyphosis. The average follow-up was 44.5 months. The mean preoperative kyphosis was 20.9°, while that at the final follow-up was −9.6°, with mean cervical kyphosis correction 30.5° for cervical kyphosis. There was significant improvement in the neck disability index, Visual Analog Scale (VAS) scores, and Nurick grades. All patients showed improved neurology, while nine patients had complete resolution of symptoms. The authors concluded that augmentation of fusion with the plate decreased the graft-related complications. However, posterior instrumented fusion to the construct was added in patients undergoing corpectomy at more than three levels. Almost 13% of patients in this series showed graft-related complications.

2. Posterior approach

A posterior-only approach is less commonly implicated in the management of cervical kyphosis. It is commonly used in conjunction with an anterior approach for circumferential fusion, and is indicated in flexible deformities, when kyphosis correction is achieved by positioning of head or traction, and whenever there is no anterior compression [28]. Abumi et al. [28] retrospectively analyzed 30 patients undergoing cervical kyphosis correction with the use of cervical pedicle screws. Of these patients, 17 had flexible kyphosis and were managed with an entirely posterior procedure. The mean preoperative kyphosis was 28.4° that improved to 5.1° at final follow-up. All patients had fusion at the final follow-up. Transient nerve root complications related to placement of the pedicle screw was reported in two patients.

Lateral mass screws are the preferred modality of fixation owing to a low complication rate compared with that of pedicle screws. However, biomechanically, they are inferior to pedicle screws. In a systemic review, Coe et al. [29] found lateral mass screws provided an adequate fusion rate and an acceptable deformity correction. Gerling et al. [30] studied nine patients with dropped head deformity and flexible kyphosis due to cervical myopathy who underwent deformity correction and posterior instrumented arthrodesis. The mean follow-up duration was 6 years. Four patients had primary cervical myopathy, while the other 5 patients had secondary cervical myopathy due to radiotherapy. Outcome measures were reported using Odom's criteria, VAS scores for neck pain, and patient satisfaction ratings. All patients showed improvement in VAS scores at the final follow-up. Seven patients had an excellent outcome, while two patients had a fair outcome as reported by Odom's criteria and patient reported measures. Though 11 complications were reported, none of the patients had neurological deterioration.

3. Combined approach

White and Panjabi [31] proposed the idea that corpectomy in patients with postlaminectomy kyphosis further destabilizes the spine. The right and left elements of the vertebrae are only connected by soft tissue that has significantly less resistance to torsion and axial forces. An anterior graft in the absence of posterior elements bears the entire axial load, which may not be prevented by halo vest immobilization alone. Therefore, there is an increased risk of graft dislodgement or subsidence. The authors strongly recommended the addition of posterior instrumented fusion in patients undergoing anterior corpectomy and fusion for postlaminectomy kyphosis.

4. Osteotomies: posterior osteotomy

Patients with rigid cervical kyphosis along with ankylosed facet joints require the use of posterior-based osteotomies for deformity correction. Although Mason et al. [32] first described posterior-based open wedge osteotomy for the treatment of cervical kyphosis, many modifications of this procedure were described for treatment of cervical kyphosis in ankylosing spondylitis. MacMaster [33] reported 15 patients with ankylosing spondylitis with severe cervical kyphosis managed by extension osteotomy at C7–T1. After osteotomy, kyphosis correction was achieved by extension of the head using spinal cord monitoring. Halo traction or internal fixation was used postoperatively to maintain the kyphosis correction. The mean cervical kyphosis was 23°, and was corrected to a mean lordosis of 31°, providing a mean kyphosis correction of 54°. However, internal fixation (Luque rods and wiring) was used in only three patients. Four patients in this series had subluxation at the osteotomy site. As this procedure was dependent on lengthening the anterior column, it was associated with a high rate of morbidity.

1) Pedicle subtraction osteotomy

PSO is a posterior closing wedge osteotomy involving resection of a wedge of the vertebral body along with superior and inferior articular processes and lamina [34]. It is most commonly performed at C7 owing to the anatomy of the vertebral artery as well as the wide diameter of spinal canal at C7–T1 [35].

Deviren et al. [35] analyzed 11 patients that underwent PSO at the cervicothoracic junction for cervicothoracic sagittal imbalance. Then patients underwent PSO at C7, whereas one patient underwent T1 PSO. Outcome measures were reported using the Neck Disability Index (NDI) scores, the 36-item Short-Form Health Survey (SF-36) scores, and the VAS scores for neck pain in nine out of the 11 patients that were followed for a mean duration of 23 months. The mean kyphosis correction was 19°, and mean CBVA correction was 36.7°. There was significant improvement in NDI, VAS, and SF-36 scores in all patients. None of the patients had any neurological complications.

2) Circumferential osteotomy

Abumi et al. [28] reported on 13 patients with fixed and rigid cervical kyphosis who were managed using combined anterior and posterior procedures. The mean preoperative kyphosis was 30.8°, and the mean cervical kyphosis at final follow-up was 0.5°. All patients had complete fusion at final follow-up. The authors concluded that circumferential osteotomies along with posterior shortening procedures with the use of pedicle screw instrumentation provided the best cervical kyphosis correction with bony fusion. Mummaneni et al. [36] retrospectively analyzed 30 patients with cervical kyphosis undergoing circumferential procedures. Anterior procedures included discectomies and corpectomies/osteotomies at one or more levels, while posterior procedures included decompression and/or osteotomies with lateral mass or pedicle screw fixation. A total of 27 patients were available for analysis at mean a follow-up period of 2.6 years. Ishihara kyphosis indices improved from a preoperative mean of −17.7 to a postoperative mean of +11.4. Furthermore, the mJOA scores improved from 10.5 to 15, while the Nurick scores improved from 3.2 to 1.3. The fusion rate was reported to be 95%. This study had significant complication rates; 33% of patients had major and minor complications, while there were four deaths. None of the patients had neurological worsening. The authors concluded that circumferential reconstruction is efficacious in treating cervical kyphosis adequately. O'Shaughnessy et al. [37] analyzed 16 patients who underwent anterior and posterior reconstruction for fixed cervical kyphosis. The mean follow-up period was 4.5 years. The C2–C7 Cobb angle improved from a preoperative mean of +38° to a mean of −10° at final follow-up, yielding a mean kyphosis correction of 48°. The mean Nurick scores improved from 2.4 prior to surgery to 1.5 at final follow-up. Excellent and good outcomes were reported in 38% and 50% of patients, respectively, as per Odom's criteria, while the fair and poor outcome groups contained 6% of the patients each. All patients had good bony fusion and maintenance of correction at final follow-up. Nottmeier et al. [38] retrospectively reviewed 41 patients undergoing circumferential reconstruction for rigid cervical kyphosis. Patients were followed for mean period of 19 months. The mean preoperative kyphosis of 18° improved to 4° of lordosis at final follow-up, resulting in a mean kyphosis correction of 22°. There was no loss of correction in any patient, while a fusion rate of 97.5% was obtained. Two patients had neurological complications (one quadriparesis and one transient C8 radiculopathy). Ogihara and Kunogi [39] reported three patients undergoing single stage anterior and posterior fusion surgery for cervical kyphotic deformity correction using an intervertebral cage and lateral mass screws. All patients were followed up for a minimum period of 61 months and showed improved symptoms following surgery. All three patients had complete fusion and maintenance of correction at final follow-up. The authors concluded that the combination of anterior cages and lateral mass screws was considered a safe and effective procedure for the cervical kyphosis correction. Shah et al. [40] reported a case of neurofibromatosis with buckling kyphosis of cervical spine. The patient was treated with circumferential osteotomy in a staged procedure. In the first stage, anterior cervical corpectomy with soft tissue release was performed. In the second stage, posterior fusion was carried out using lateral mass screws.

The authors presented a case of rigid cervicothoracic kyphosis with chin to chest deformity that was managed with circumferential fusion during the same surgery (Fig. 3). The patient was a 46-year-old male presenting with short duration of early myelopathy along with rigid cervicothoracic kyphosis and subluxation of C5 over C6. A preoperative CT scan demonstrated ankylosis of the facet joints (Fig. 3G); hence, posterior-based Smith-Peterson osteotomy (SPO) was planned first at C5–C6. Anterior stabilization was performed later to augment the posterior fixation. Good deformity correction was clinically evident

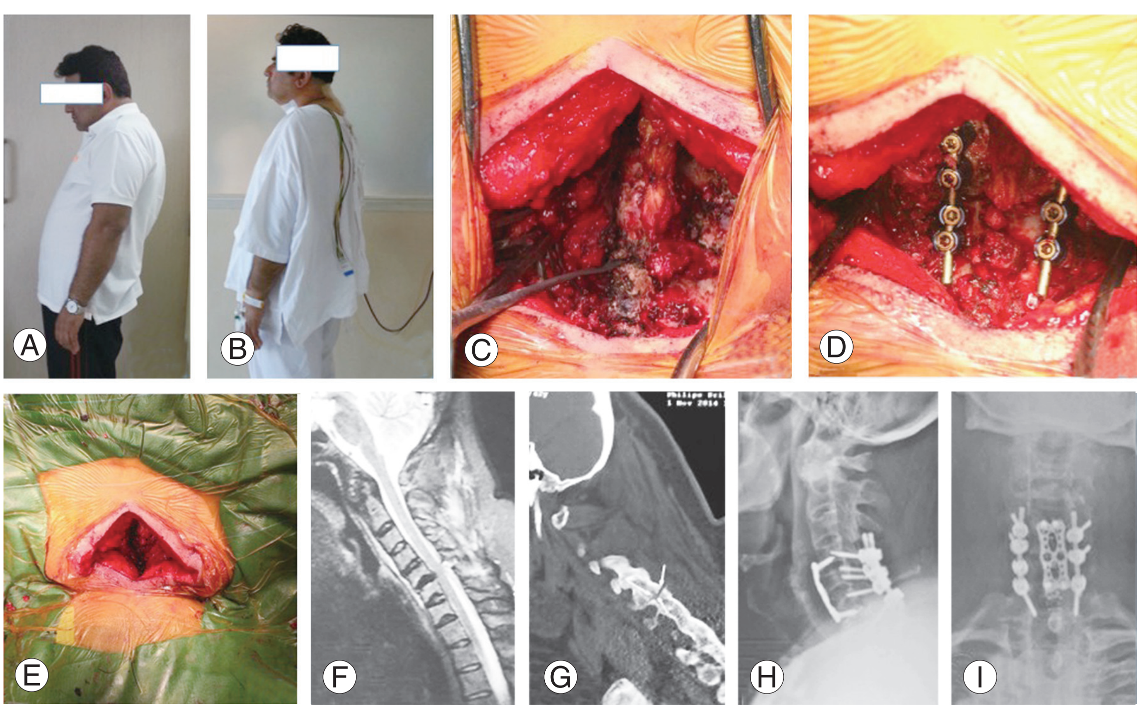

Fig. 3. (A) Preoperative clinical photograph showing chin to chest deformity. (B) Postoperative clinical photograph showing deformity correction. (C, D) Intraoperative photographs showing osteotomy site. (E) Intra-operative photograph showing the distortion of skin incision after deformity correction. (F) Preoperative magnetic resonance imaging scan. (G) Preoperative computed tomography scan facetal fusion. (H, I) Postoperative lateral and anterior view showing deformity correction.

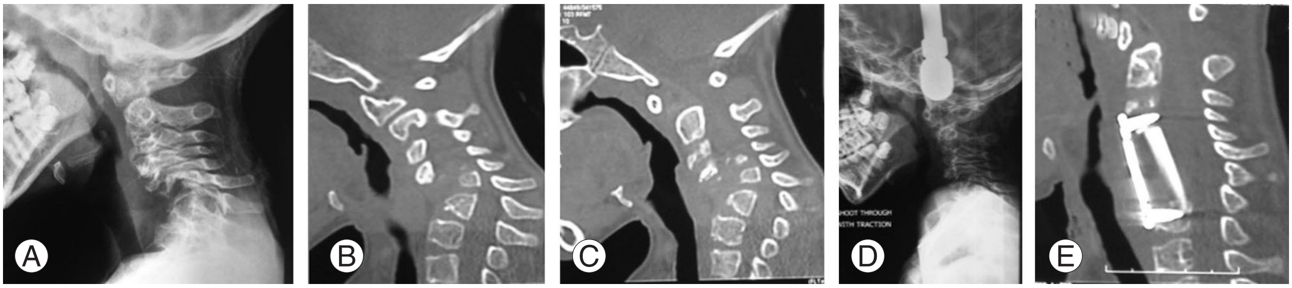

Fig. 4. (A) Preoperative radiograph showing kyphosis in the midcervical spine. **(B, C)** Preoperative computed tomography scan showing kyphosis with dislocated facet joints secondary to tuberculosis. **(D)** Intraoperative skull traction depicting the ability of kyphosis correction. **(E)** Postoperative radiograph showing deformity correction.

(Fig. 3B) as well as on postoperative X-ray (Fig. 3H).

The second case was a 38-year-old female with C5–C6 subluxation with focal kyphosis of 62° due to tuberculous spondylodiscitis, with full-blown myelopathy. A CT scan demonstrated complete destruction of the C5 and C4 body. The patient was managed with preoperative cervical traction for one week to determine how to correct the alignment of the cervical spine. There was a substantial improvement in angulation as well as translation with cervical traction (Fig. 4D). A later definitive procedure involved C4 and C5 corpectomy and anterior fusion using an autogenous iliac crest bone graft and anterior reconstruction plate (Fig. 4E). It was decided to avoid posterior stabilization as anterior stabilization was stable and the patient showed significant improvement, both clinically and radiologically.

3) Anterior osteotomy

Anterior cervical osteotomy for fixed cervical deformity correction is not well-documented in the literature. Kim et al. [41] reported a case series of 38 patients who underwent either anterior osteotomy alone or in combination with posterior osteotomy for fixed cervical kyphosis correction. In their study, 17 patients (group 1) underwent anterior-only osteotomy with or without posterior instrumentation, while 21 patients (group 2) underwent an additional SPO with posterior instrumentation. The mean deformity correction in group 1 was less compared to that of group 2 (23 versus 33), but was statistically insignificant. Both the groups showed improved NDI scores and were similar in both groups (20 versus 19.7). The mean correction in the translation of group 1 was compared with that of group 2 (1.3 versus 3.7 cm). None of the patients had neurological adverse events following surgery. The authors concluded that anterior osteotomy is safe and effective for fixed cervical kyphosis correction, and the addition of SPO can provide a good translational and angular correction where necessary.

Conclusions

Subaxial cervical kyphosis is a rare but complex condition that can lead to significant neurological compromise as well as functional disability, such as difficulty in ambulation, swallowing, and respiration, as well as loss of horizontal gaze. Surgical treatment of this challenging pathology is a daunting task and focuses on neural decompression, and improvement in alignment and stabilization of the cervical spine. Flexible deformities are preferably managed by posterior stabilization provided the alignment of cervical spine is restored optimally. Fixed deformities are treated using skeletal traction for a brief period before deciding the surgical approach. An anterior approach is preferable in short segment cervical kyphosis with anterior compression of spinal cord requiring one to two-level corpectomy. A circumferential approach has the advantage of rigid fixation and restoration of posterior tension band. Though radical, it reduces the chances of instrumentation failure, graft extrusion, and pseudoarthrosis. As the benefits of this approach outweigh the potential complications, the morbidity of circumferential cervical spine surgeries is decreased by use of proper techniques and experience.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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