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Dropped Head Syndrome: A Spine Surgeon's Framework for Surgical Decision-Making and Fusion-Level Selection

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Abstract

Adult Dropped Head Syndrome (DHS) is an uncommon but disabling condition in which failure of the cervical extensor mechanism leads to a chin-on-chest posture and loss of horizontal gaze. Its true population prevalence is unknown because the condition is rare, etiologically heterogeneous, and reported mainly through small series and reviews. The diagnosis is often clinically recognizable, but the underlying causes include isolated neck extensor myopathy, inflammatory and neuromuscular disorders, Parkinsonian syndromes, motor neuron disease, cervical spondylotic disease, post-surgical deformity, radiation-related myopathy, and iatrogenic muscle injury. For the spine surgeon, the central issue is not simply confirming DHS, but determining when a flexible neuromuscular postural problem has become a structural deformity requiring reconstruction.

This adult-focused narrative review discusses DHS from a surgical decision-making perspective. Emphasis is placed on identifying reversible causes, distinguishing flexible from fixed deformity, assessing neurological compromise, evaluating whole-spine sagittal alignment, and planning durable fixation. The evidence base remains limited and consists largely of case reports, retrospective series, and systematic reviews of heterogeneous cohorts. Nonoperative treatment remains appropriate for early, flexible, or medically treatable cases, but recent pooled evidence suggests that surgical reconstruction provides the most reliable restoration of horizontal gaze in selected patients with disabling or progressive deformity.

The major technical decisions include the need for decompression, the role of anterior release or osteotomy, whether to include the occiput, and how far distally to extend the fusion. In most surgically significant cases, C2 provides a useful upper anchor while preserving occipitocervical motion. Distally, constructs should usually cross the cervicothoracic junction, particularly in patients with poor extensor muscle quality, osteoporosis, high T1 slope, thoracic kyphosis, or global sagittal malalignment. The objective is durable restoration of functional horizontal gaze, not radiographic perfection.

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Introduction

Dropped Head Syndrome is one of the more recognizable yet less frequently encountered deformities in adult spine practice. Its true population prevalence is not established, and most available evidence comes from case reports, small retrospective series, and systematic reviews rather than population-based studies. It has been described as a rare manifestation in neuromuscular populations, and even recent systematic reviews still capture only hundreds of reported patients rather than large epidemiologic cohorts. Patients present with an inability to maintain the head upright against gravity, often with neck fatigue, impaired horizontal gaze, difficulty eating, dysphagia, unsafe ambulation, and progressive social limitation. In early forms, the deformity may be passively correctable. In advanced cases, an initially functional problem can become structural through disc degeneration, facet contracture, anterior column shortening, posterior tension-band attenuation, and compensatory failure elsewhere in the spine [1-10].

A useful way to conceptualize DHS is as a self-reinforcing cycle. Early extensor weakness allows the head to translate forward. The increased flexion moment makes the extensor muscles work at a mechanical disadvantage, leading to fatigue, disuse, fatty degeneration, and further loss of extension strength. Over time, the soft-tissue problem may acquire a fixed osseous and ligamentous component. This transition is the point at which the surgeon's role changes from diagnosis and support to deformity reconstruction.

DHS is not a single diagnosis. It is the visible endpoint of disorders affecting the posterior extensor mechanism, neuromuscular control, cervical alignment, and whole-spine compensation. Reported causes include isolated neck extensor myopathy, myasthenia gravis, amyotrophic lateral sclerosis, Parkinson disease, inflammatory myopathies, chronic inflammatory demyelinating polyneuropathy, radiation-related injury, cervical spondylotic disease, postlaminectomy or postlaminoplasty deformity, botulinum toxin-related weakness, and denervation following cervical radiofrequency procedures. This broad differential is the first reason DHS should not be treated as a purely mechanical disorder at presentation [11-18].

For the spine surgeon, the practical dilemma is usually not whether DHS exists, but whether the patient has crossed the threshold from a medically treatable postural disorder to a progressive deformity requiring reconstruction. That threshold is defined by progression, fixed deformity, neurological compromise, disabling loss of horizontal gaze, dysphagia, pain, failure of nonoperative care, and the patient's ability to tolerate major surgery. This review synthesizes the available literature into a practical framework for evaluation, surgical indication, approach selection, fusion-level planning, and complication avoidance.

Literature Search Strategy

A focused adult narrative literature search was performed to identify clinically relevant evidence on DHS etiology, diagnosis, conservative treatment, surgical correction, fusion levels, outcomes, complications, and global sagittal alignment. Searches were performed using PubMed, Google Scholar, SpringerLink, and open-access databases, with the final search update performed in July 2026. Search terms included dropped head syndrome, chin-on-chest deformity, isolated neck extensor myopathy, dropped head syndrome surgery, cervicothoracic fusion, occipitocervical fusion, horizontal gaze, cervical kyphosis, adult cervical deformity, T1 slope, C2-C7 sagittal vertical axis, and spinopelvic alignment dropped head syndrome. This review focuses on adult DHS; pediatric deformity and primary pediatric neuromuscular spine conditions were outside the scope of the manuscript.

Because this article is a narrative surgical perspective rather than a formal systematic review, no pooled analysis was performed for this manuscript. One author screened titles, abstracts, and full texts for relevance to surgical decision-making. Priority was given to DHS-specific systematic reviews and meta-analyses, larger case series, studies reporting surgical constructs and complications, and adult cervical deformity literature relevant to radiographic planning. Case reports were retained when they illustrated uncommon etiologies, iatrogenic mechanisms, osteotomy-based reconstruction, or complications relevant to decision-making. The selection process therefore reflects clinical relevance and author judgment, and the proposed framework should be read as an expert synthesis rather than a validated treatment guideline.

For transparency, the most recent quantitative synthesis identified was the 2025 systematic review and single-arm meta-analysis by Brandão et al., which pooled 19 studies and 472 patients with DHS [19]. That study provides useful quantitative context, but its authors also reported important limitations, including heterogeneous indications, variable outcome definitions, and substantial risk of bias across many included studies.

Table 1: Key Studies Informing Surgical Decision-Making in DHS

Author / year	Design / scope	Key contribution	Surgical relevance
Suarez and Kelly, 1992 [1]	4 patients	Early clinical description of head drop from neck extensor weakness.	Established DHS as a recognizable neuromuscular syndrome.
Katz et al., 1996 [2]	4 patients	Defined isolated neck extensor myopathy.	Supports neuromuscular workup before fusion.
Amin et al., 2004 [3]	Case-based surgical review	Examined whether surgery has a role in DHS.	Early surgical reference for selected severe cases.
Petheram et al., 2008 [4]	7-patient series and review	Brought DHS into the orthopaedic spine literature.	Emphasized careful patient selection.
Gerling and Bohlman, 2008 [5]	9-patient long-term series	Reported outcomes after posterior cervicothoracic fusion.	Classic series for counseling and construct planning.
Martin et al., 2011 [6]	Case report and review	Highlighted persistent diagnostic workup and reversible causes.	Supports medical workup before reconstruction.
Sharan et al., 2012 [7]	Review	Summarized etiology and management.	Useful framework for nonoperative versus operative sequencing.
Drain et al., 2019 [8]	Systematic review, 129 patients	Reported etiologies, treatment response, and algorithm.	Supports diagnosis-first management and selective surgery.
Brodell et al., 2020 [9]	Review	Updated etiology and surgical management.	Highlights limited evidence and high complication burden.
Cavagnaro et al., 2022 [10]	Systematic review, 54 surgical patients	Compared cervical-only and cervicothoracic arthrodesis.	Strongest support for crossing the cervicothoracic junction.
Hashimoto / Murata / Qian, 2018-2021 [11,12,14]	Radiographic studies	Defined DHS alignment patterns and compensation.	Supports standing whole-spine assessment.
Kudo et al., 2020 [13]	Multicenter surgical study, 15 patients	Linked failure with global sagittal parameters.	Supports spinopelvic evaluation before surgery.
Miyamoto et al., 2023 [15]	40-patient surgical series	Proposed strategy using T1 slope and correction targets.	Modern evidence for alignment-based surgical planning.
Koda / Stoker / Bajaj, 2013-2022 [16-18]	Iatrogenic DHS reports	Described DHS after laminoplasty and denervation procedures.	Important for prevention and history-taking.
Ames / Hyun / Passias / Schwab [19-21,27]	Cervical and adult deformity literature	Provided alignment language and DJK risk concepts.	Supports CBVA, TS-CL, SVA, and spinopelvic planning.
Brandão et al., 2025 [30]	Systematic review and single-arm meta-analysis, 19 studies and 472 patients	Compared conservative and surgical treatment success, total improvement, partial improvement, and failure rates.	Provides the most recent pooled estimate supporting surgery for selected disabling DHS, while highlighting bias and heterogeneity.

Structured Five-Phase Framework

For clinical applicability, I organize DHS management into five phases. Phase I is diagnostic triage: confirm DHS, exclude mimics, identify reversible neuromuscular or inflammatory disease, and determine deformity flexibility. Phase II is radiographic and alignment analysis: evaluate the cervical spine, cervicothoracic junction, and global sagittal balance. Phase III is treatment selection: decide whether conservative care is still appropriate or whether surgery is indicated. Phase IV is fusion-level selection: choose the upper and lower instrumented vertebrae based on pathology and biomechanics. Phase V is risk management: anticipate neurological, dysphagia, airway, wound, medical, and mechanical complications.

This framework is not intended to replace surgeon judgment and has not been externally validated. Its value is practical: it forces the surgeon to pause at the decisions most likely to determine success or failure--reversible etiology, flexibility, neurological compromise, global alignment, occipital inclusion, cervicothoracic extension, and patient biology.

Etiology and Clinical Classification

The common final pathway in DHS is failure of the cervical extensor mechanism to counterbalance the flexion moment of the head. In early disease, passive correction suggests weakness, fatigue, denervation, or poor neuromuscular control. With time, structural changes may convert a dynamic postural problem into a fixed deformity [6-9].

The reported etiologies are broad. Neurological and neuromuscular causes include myasthenia gravis, amyotrophic lateral sclerosis, Parkinson disease and related Parkinsonian syndromes, motor neuron disease, chronic inflammatory demyelinating polyneuropathy, and other neuropathies [6-9]. Muscular causes include isolated neck extensor myopathy, inflammatory myopathy, inclusion body myositis, mitochondrial myopathy, hypothyroid myopathy, radiation-associated myopathy, and age-related sarcopenia [2,6-9,23,26]. Structural causes include cervical spondylotic myelopathy, degenerative kyphosis, postlaminectomy or postlaminoplasty deformity, ankylosing disorders, osteoporotic collapse, and severe cervicothoracic sagittal malalignment [6,7,11-16,24,25]. Iatrogenic causes have been described after cervical surgery, radiation therapy, botulinum toxin exposure, and multilevel cervical radiofrequency ablation or neurotomy [16-18]. For operative planning, etiologic classification alone is not enough. The surgeon should classify DHS according to four questions. First, is the cause medically reversible or controllable? Second, is the deformity flexible or fixed? Third, is there neurological compromise? Fourth, is the deformity primarily regional or part of global sagittal imbalance? These four questions are more useful for surgical planning than the diagnosis label alone.

Diagnostic Workup

Clinical and Neuromuscular Evaluation

The diagnostic workup has two goals: identify treatable causes of head drop and determine whether the deformity has become structural. The history should clarify onset, tempo, functional impact, neurological symptoms, dysphagia, aspiration, weight loss, previous cervical surgery, radiation exposure, botulinum toxin injection, radiofrequency procedures, and known neuromuscular disease [6,7,16-18].

Physical examination should determine whether the deformity is actively and passively correctable. The patient should be assessed standing, sitting, and supine. Active cervical extension strength, endurance, shoulder girdle strength, scapular stabilizers, paraspinal bulk, gait, and compensatory thoracic or lumbar posture should be evaluated. Neurological examination should look for myelopathy, radiculopathy, fatigability, ocular symptoms, bulbar signs, tremor, rigidity, fasciculations, and generalized limb weakness.

Neurology referral is appropriate when generalized weakness, fatigability, bulbar involvement, fasciculations, tremor, rigidity, gait disturbance, or unexplained rapid progression is present. Laboratory testing may include creatine kinase, thyroid function tests, inflammatory markers, autoimmune myositis markers, acetylcholine receptor antibodies, muscle-specific kinase antibodies, vitamin D, and nutritional markers. Electromyography and nerve conduction studies help distinguish myopathic, neurogenic, neuromuscular junction, and motor neuron patterns. Muscle biopsy is selective, but may be helpful when inflammatory myopathy or isolated neck extensor myopathy remains uncertain [2,6-8].

Radiographic and Alignment Evaluation

Radiographic assessment should begin with standing cervical radiographs, but it should not end there. Standing full-length spine radiographs are important in patients being considered for surgery because the apparent cervical deformity may reflect failure at the cervicothoracic junction, thoracic kyphosis, lumbar compensation, pelvic retroversion, or global sagittal imbalance [11-14].

Recommended measurements include C2-C7 sagittal vertical axis, C2-C7 Cobb angle, chin-brow vertical angle, C0-C2 alignment, T1 slope, T1 slope minus cervical lordosis, thoracic kyphosis, global sagittal vertical axis, lumbar lordosis, pelvic incidence, pelvic tilt, and PI-LL mismatch when global imbalance is suspected [11-15,19-21,27]. The chin-brow vertical angle is useful because it translates radiographic planning into the functional target of horizontal gaze.

Dynamic flexion-extension radiographs, supine lateral radiographs, extension views, or traction images help determine flexibility. A deformity that corrects substantially when supine or in extension is mechanically different from one that remains fixed. MRI evaluates neural compression, cord signal change, stenosis, disc pathology, foraminal compromise, and paraspinal muscle quality. CT is useful for rigid deformity, prior surgery, suspected ankylosis, C2 or thoracic pedicle screw planning, and osteotomy planning.

The alignment categories in Table 2 are proposed as a practical planning aid. They are derived from concepts in DHS radiographic studies, the SRS-Schwab framework, and adult cervical deformity classifications, but they are not a validated DHS taxonomy [11-15,19,27].

Table 2: Author-Proposed Practical Global Alignment Stratification for DHS Surgical Planning. This is an unvalidated framework intended to complement, not replace, established adult cervical and thoracolumbar deformity classifications

Alignment pattern	Typical features	Planning implication
Compensated regional DHS	Horizontal gaze impaired, but global SVA and PI-LL remain acceptable.	Cervicothoracic reconstruction may be sufficient if the deformity is structurally surgical.
Decompensated global balance	Positive global SVA or compensatory pelvic retroversion with cervical deformity.	Higher risk of recurrence or distal failure; avoid short constructs and counsel carefully.
Masked thoracolumbar deformity	PI-LL mismatch, thoracolumbar kyphosis, or lumbar compensation contributes to head position.	Cervical-only correction may not be durable; staged or broader deformity strategy may be needed.

Nonoperative Management and Indications for Surgery

Nonoperative management is appropriate for many patients, especially when the deformity is early, flexible, medically treatable, or not associated with neurological compromise. It should not be viewed as passive delay. It is a diagnostic and therapeutic trial that helps determine whether the head drop is reversible, progressive, or already structural. At the same time, the expectations must be honest. The 2025 meta-analysis by Brandão et al. found that conservative care often produced partial symptom improvement, but achieved a low pooled success rate when success was defined as restoration of horizontal gaze, correction of sagittal alignment, and neural decompression when needed [30].

The first principle is to treat the underlying cause when identified. Myasthenia gravis, inflammatory myopathy, hypothyroid myopathy, medication-related dystonia, and immune-mediated neuromuscular disease may improve with disease-specific treatment [6-8]. Physical therapy should focus on cervical extensor endurance, scapular stabilization, thoracic extension, postural retraining, gait safety, and conditioning. Orthoses may temporarily improve gaze and reduce fatigue, but long-term bracing is often limited by skin pressure, mandibular discomfort, dysphagia, reduced mobility, and further extensor deconditioning [7-9].

A structured nonoperative trial is reasonable when the deformity is flexible, progression is slow, the patient is neurologically intact, and a reversible medical cause is being treated. Prolonged conservative care is less appropriate when the deformity is worsening. A flexible deformity may become fixed; swallowing and ambulation may deteriorate; and compensatory mechanisms may fail. Serial reassessment is therefore essential.

Surgery is considered when DHS becomes progressive, disabling, neurologically significant, or structurally unlikely to recover. Indications include myelopathy or radiculopathy, cord compression or cord signal change, disabling loss of horizontal gaze, unsafe ambulation, dysphagia, severe refractory pain associated with structural deformity, fixed kyphosis, progressive sagittal imbalance, and failure of a meaningful nonoperative program [8-10,24,30]. Brandão et al. reported pooled surgical success near 100% in the available literature, but this estimate should be interpreted in the context of selection bias, heterogeneous cohorts, and largely non-randomized evidence [30].

The decision to operate should include honest counseling. DHS reconstruction often requires long posterior fixation, extension across the cervicothoracic junction, and occasionally anterior release or osteotomy. Patients should understand the likely loss of motion, dysphagia risk, C5 palsy or neurological risk, pseudarthrosis, junctional failure, and the possibility of revision surgery. At the same time, surgery should not be dismissed simply because the patient is elderly or the deformity is uncommon. In well-selected patients, restoration of gaze can be life-changing.

Preoperative Planning and Surgical Strategy

Preoperative planning should begin with a clear statement of the surgical problem. The operation must restore a functional head position, protect or decompress neural elements, obtain fixation strong enough to resist the flexion moment of the head, and account for weak or atrophic posterior musculature. The plan should answer five questions: Is the deformity flexible or fixed? Is decompression required? Is the deformity cervical, cervicothoracic, or part of global imbalance? What are the appropriate upper and lower instrumented levels? Can the patient biologically and medically tolerate the reconstruction?

Correction Target

The primary goal is comfortable horizontal gaze. This is different from simply restoring lordosis. Overcorrection may impair downward gaze, eating, reading, and swallowing; under correction may leave the patient unsafe to ambulate. Preoperative photographs, standing radiographs, chin-brow vertical angle, and clinical positioning can help define the target. The planned correction must be functional before it is radiographic.

Flexibility, Decompression, and Approach Selection

A flexible deformity that corrects with positioning may be treated with posterior instrumented fusion if there is no major anterior column collapse or irreducible anterior compression. A fixed deformity suggests disc collapse, facet contracture, anterior column shortening, ankylosis, prior fusion, or rigid cervicothoracic kyphosis. In that setting, anterior release, posterior column osteotomy, pedicle subtraction osteotomy, or circumferential reconstruction may be required [20-30].

If myelopathy, radiculopathy, cord compression, or cord signal change is present, decompression must be incorporated into the reconstruction plan. Laminectomy alone in a kyphotic or unstable DHS patient may worsen sagittal alignment. Correction without adequate decompression may place an already compromised cord at risk. Neuromonitoring should be considered for myelopathy, fixed deformity, osteotomy, revision surgery, or major correction.

Biological Optimization

DHS reconstruction is often performed in older patients with sarcopenia, osteoporosis, dysphagia, frailty, malnutrition, or neurodegenerative disease. These factors affect screw purchase, fusion potential, complication risk, rehabilitation capacity, and construct durability. Optimization should include bone health assessment, vitamin D correction, nutrition, glycemic control, smoking cessation, pulmonary assessment when indicated, and swallowing evaluation when dysphagia is present.

Osteoporosis is not a minor comorbidity in DHS. It directly affects fixation strength and junctional failure risk. When time allows, osteoporosis treatment should be started preoperatively. In high-risk osteoporotic patients, anabolic therapy such as teriparatide may be considered according to local practice and patient-specific factors. The wording is deliberately cautious: it is a risk-reduction strategy, not a guarantee against failure.

Resource-Dependent Feasibility

The ideal DHS workup and reconstruction often assume tertiary-center resources: full-length standing radiographs, MRI and CT, neurology input, bone health optimization, anesthesiology experience with difficult airways, swallowing evaluation, intraoperative neuromonitoring, and sometimes CT navigation or navigation-assisted fixation. These resources are not universally available. In lower-resource settings, the principles remain the same but the operation should be adapted to what can be performed safely. When neuromonitoring or navigation is unavailable, the threshold for aggressive correction, cervical pedicle fixation, or osteotomy should be higher; more conservative correction targets, robust fluoroscopic confirmation, careful preoperative CT review when available, and referral to a deformity center should be considered for rigid, myelopathic, revision, or high-risk cases. The algorithm in this paper is therefore a framework, not a mandate to perform complex reconstruction without the necessary team and safeguards.

Fusion-Level Selection

The upper instrumented level should provide durable proximal control while preserving function. In many surgically significant cases, C2 is preferred because it offers strong purchase while avoiding the functional cost of occipital fixation. C2 pedicle, pars, translaminar, or laminar screws may be chosen depending on anatomy, vertebral artery course, and surgeon experience.

The occiput should not be included reflexively. Occipitocervical fusion restricts head motion, reduces rotation, may impair downward gaze, and can worsen dysphagia if fixed in suboptimal alignment. Occipital fixation is appropriate when there is craniovertebral instability, severe C0-C2 deformity, basilar invagination, destructive pathology, failed upper cervical fixation, or inadequate C1-C2 fixation options. The decision should be made on pathology, not habit.

The lower instrumented level is often the most consequential decision. The cervicothoracic junction is a high-stress transition zone, and the head acts as a long flexion lever arm. Cervical-only constructs have been associated with high failure in DHS; Cavagnaro et al. reported a 71% failure rate for cervical arthrodesis without thoracic extension compared with 13% for cervicothoracic arthrodesis [10]. A practical minimum distal level is often T2, with extension to T3-T5 considered for severe deformity, high T1 slope, thoracic kyphosis, osteoporosis, poor extensor muscle quality, revision surgery, or abnormal global alignment [10,13,15].

A useful intraoperative and radiographic heuristic is the basion plumb line. If a line dropped from the basion falls anterior to the manubrium, the thoracic spine should be included in the construct, often to T3, T4, or T5 depending on alignment and bone quality. This rule should not replace formal planning, but it is a practical reminder that the fusion must control the head over the trunk, not merely the cervical curve.

Table 3: Author-Proposed Fusion-Level Decision Table for DHS. These recommendations synthesize published DHS and Adult Cervical Deformity literature but are not externally validated as a formal classification or guideline

Decision point	Preferred strategy	When to extend or modify	Rationale
UIV	C2 in most surgically significant cases.	Include occiput only for CVJ instability, C0-C2 deformity, failed upper cervical fixation, or inadequate C2 options.	C2 gives strong purchase while preserving occipitocervical motion.
Occiput	Avoid routine inclusion.	Use when pathology requires proximal control.	Occipital fusion has functional cost and may worsen dysphagia or gaze if malpositioned.
LIV	Cross the cervicothoracic junction in most operative DHS cases.	T2 minimum in many cases; T3-T5 for high-risk deformity, poor bone, thoracic kyphosis, or revision.	Thoracic anchors reduce stress at the transition zone.
Anterior support	Posterior-only if flexible and no major anterior pathology.	Add anterior release/reconstruction for fixed kyphosis, anterior collapse, or anterior compression.	Improves release and load sharing but increases morbidity.
Osteotomy	Avoid if correction is obtained with positioning/release.	Consider for rigid chin-on-chest deformity or ankylosis.	Fixed deformity may not correct safely with instrumentation alone.
Correction target	Functional horizontal gaze.	Adjust for CBVA, T1 slope, swallowing, and global alignment.	Patient function matters more than idealized lordosis.

Surgical Options and Technical Considerations

Posterior Instrumented Fusion Alone

Posterior instrumented fusion is the most practical strategy for flexible or partially flexible DHS when the desired head position can be achieved with positioning and there is no major anterior column collapse or irreducible anterior compression. A typical construct begins at C2 and extends across the cervicothoracic junction to at least T2, often T3-T5 in higher-risk cases [10,13,15].

Positioning is part of the correction. The head should be secured in the planned gaze, avoiding excessive extension. After exposure, C2 fixation may be combined with sub axial lateral mass or cervical pedicle screws and upper thoracic pedicle screws. Rods should be contoured to the desired profile and connected without forcing abrupt extension. Segmental compression, distraction, cantilever maneuvers, facetectomies, and posterior column releases may be used judiciously. The fusion bed should receive the same attention as the hardware: broad decortication and adequate graft volume are essential.

Combined Anterior-Posterior Reconstruction

Combined reconstruction is considered when fixed kyphosis, anterior column shortening, severe disc collapse, anterior cord compression, pseudarthrosis, prior failed surgery, or need for anterior support is present. The anterior stage may include multilevel discectomy and fusion, corpectomy, anterior release, or restoration of anterior column height. The posterior stage provides definitive tension-band reconstruction and long-segment stability. The benefit is greater release and load sharing; the cost is increased operative time, blood loss, dysphagia risk, airway concern, and physiological stress.

Osteotomy-Based Correction

Osteotomy is reserved for rigid deformity that cannot be corrected safely by positioning or release alone. Posterior column osteotomies may be enough when the anterior column remains mobile. Pedicle subtraction osteotomy or more powerful three-column correction may be required for severe fixed deformity, particularly near the cervicothoracic junction [22,23]. The correction target should be defined before bone is removed. Decompression, neuromonitoring, strong fixation, gradual correction, and avoidance of overcorrection are critical.

Airway, Dysphagia, and Postoperative Protection

Severe chin-on-chest deformity can make intubation difficult, and the airway plan should be discussed with anesthesia before surgery. Some patients require awake fiberoptic intubation or other advanced techniques. Dysphagia should be documented preoperatively because it may improve after correction but may also worsen after anterior approaches, excessive correction, postoperative swelling, or occipitocervical malalignment [10,29]. Miyamoto's report is a useful reminder that swallowing difficulty after DHS correction may be related not only to the approach but also to the final cervical alignment and pharyngeal airway space [29].

Postoperative care should include immobilization strategy, swallowing precautions, pulmonary care, nutrition, fall prevention, osteoporosis management, and supervised rehabilitation. Follow-up radiographs should evaluate horizontal gaze, implant integrity, fusion progression, and distal junctional alignment. Mechanical failure may occur late; follow-up should not end after early wound healing.

Outcomes and Complications

The available literature suggests that selected patients can improve after DHS reconstruction, particularly in horizontal gaze, pain, ambulation, and daily function. The evidence should still be interpreted carefully because most studies are small, retrospective, and heterogeneous. Gerling and Bohlman reported improved pain and satisfaction after posterior cervicothoracic fusion in nine patients with cervical myopathy-related dropped head deformity [5]. Cavagnaro et al. reviewed 54 surgically treated patients and found that surgery generally restored horizontal gaze and maintained or improved neurological status in most cases [10]. Miyamoto et al. reported restoration of horizontal gaze in 40 consecutive surgically treated patients, with transient C5 palsy and distal junctional kyphosis among reported complications [15]. Brandão et al. provided the most recent pooled comparison, including 19 studies and 472 patients; they reported markedly higher surgical success than conservative success, while also documenting risk of bias and heterogeneity across the evidence base [30].

Mechanical failure is the dominant complication. It may present as distal junctional kyphosis, distal junctional failure, screw loosening, screw pullout, rod fracture, pseudarthrosis, adjacent segment failure, or recurrent head drop. Kudo et al. reported recurrence of sagittal imbalance or horizontal gaze difficulty in 40% of surgically treated patients and distal junctional failure requiring multiple surgeries in 20% [13]. Adult cervical deformity literature similarly identifies baseline malalignment and procedure-related factors as risks for distal junctional kyphosis [21,28]. A recent cervicothoracic DJK/DJF narrative review further emphasizes osteoporosis, frailty, increased T1 slope, paraspinal weakness, and surgical factors as modifiable or anticipatable risks during planning [28].

Neurological complications may occur from decompression, instrumentation, osteotomy, or correction. C5 palsy is a known risk after cervical decompression and deformity correction. Spinal cord injury is uncommon but serious; risk is higher in myelopathy, fixed deformity, osteotomy, and revision surgery. Dysphagia and airway complications are particularly relevant because many patients already have swallowing or airway vulnerability before surgery. Wound, infection, pulmonary, delirium, thromboembolic, and deconditioning risks must also be anticipated in frail or elderly patients.

Functional morbidity should be discussed honestly. A successful fusion may restore gaze but permanently reduce cervical motion. Patients may have difficulty looking down at the floor, reversing a car, checking blind spots, or performing activities requiring head rotation. This is another reason to avoid routine occipital inclusion and to define the correction target around daily function.

Table 4: Expected Benefits and Complications after DHS Reconstruction

Domain	Expected benefit or risk	Planning implication
Horizontal gaze	Frequently improves in selected surgical patients [5,10,15].	Correction target should be functional and not excessive.
Pain and function	Pain, fatigue, and ambulation may improve when deformity is mechanical [5,10].	Improvement is less predictable in progressive neuromuscular disease.
Neurology	Myelopathy/radiculopathy may stabilize or improve after adequate decompression [10,24].	Chronic cord injury may recover incompletely.
Mechanical failure	DJK, screw loosening, rod failure, pseudarthrosis, recurrence [10,13,21].	Cross CT junction; optimize bone; avoid short constructs.
Dysphagia/airway	Can improve with gaze restoration but may worsen after anterior or O-C fusion [10].	Plan airway and swallowing assessment in high-risk patients.
Functional motion loss	Long fusion reduces residual neck motion.	Counsel regarding driving, downward gaze, falls, and activities of daily living.
Medical risk	Frailty, sarcopenia, malnutrition, and pulmonary risk influence recovery [10,13,26].	Optimize before surgery and plan rehabilitation early.

Table 5: Author-Assessed Evidence Confidence for Major Practical Recommendations. This is not a Formal Grade Assessment; It is an at-a-Glance Calibration of Confidence Based on the available DHS and Adult Cervical Deformity Literature

Recommendation	Main evidence base	Confidence	Interpretation
Exclude reversible neuromuscular, inflammatory, endocrine, or iatrogenic causes before fusion.	Reviews and systematic reviews [6-9,30].	Moderate for workup; low for specific tests.	Strong diagnostic principle despite limited comparative data.
Use nonoperative care for early, flexible, medically treatable, neurologically safe DHS.	Systematic reviews and conservative series [7-9,30].	Low to moderate.	Reasonable first step, but monitor closely for progression or fixation.
Consider surgery for progressive, fixed, disabling, myelopathic, dysphagic, or failed conservative cases.	Surgical series and pooled reviews [5,10,15,30].	Moderate for selected patients; low for exact timing.	Evidence favors surgery in severe selected DHS, but selection bias is substantial.
Cross the cervicothoracic junction in most surgically significant DHS reconstructions.	DHS systematic review and DJK/DJF literature [10,28].	Moderate.	Most actionable mechanical recommendation; individualize LIV by alignment and bone quality.
Use C2 as UIV when the craniocervical junction is stable; avoid routine occipital inclusion.	DHS surgical review and alignment studies [10,14,30].	Low to moderate.	Supported by construct patterns and functional reasoning, not randomized evidence.
Assess whole-spine sagittal alignment before surgery.	Radiographic DHS studies and deformity literature [11-15,19-21,27].	Moderate.	Important to avoid under-recognizing global contributors to failure.
Plan airway, swallowing, bone health, frailty, and rehabilitation before reconstruction.	DHS complication reports, dysphagia study, DJK/DJF review [10,26,28,29].	Low to moderate.	Clinically essential risk management, though DHS-specific prospective data are limited.
Use osteotomy or circumferential reconstruction only when deformity rigidity or anterior pathology requires it.	Case reports/series and deformity principles [22,23].	Low.	Technically appropriate for selected rigid cases; evidence is mainly case-based.

Discussion

DHS is deceptively simple in appearance. The chin-on-chest posture immediately communicates the problem, but it does not explain the cause, reversibility, or appropriate operation. In my view, this is the central trap of DHS: the deformity is visible, but the driver is often hidden. The surgeon must decide whether the patient has a medically treatable postural disorder, progressive neuromuscular disease, structural cervical deformity, or a component of global sagittal imbalance.

The literature supports a diagnosis-first approach. Reviews by Martin, Sharan, Drain, and Brodell emphasize heterogeneous etiologies and the importance of identifying reversible disease before fusion [6-9]. Brandão et al. add a useful contemporary quantitative perspective: conservative treatment may help symptoms in some patients, but surgical treatment was far more likely to restore horizontal gaze and meet functional success definitions in the pooled literature [30]. This does not mean every patient should undergo early surgery. It means that conservative care should have a purpose, a timeline, and a reassessment point.

The major surgical lesson remains mechanical. A dropped head is a long lever-arm problem acting on a spine that may have poor muscle support, poor bone, and limited compensation. This explains why short cervical constructs are vulnerable. The systematic review by Cavagnaro et al. provides the clearest DHS-specific evidence supporting cervicothoracic extension [10]. Kudo et al. add that global sagittal alignment influences failure [13]. Martinez et al. further frame DJK and DJF as cervicothoracic complications shaped by osteoporosis, frailty, T1 slope, paraspinal weakness, and surgical factors [28]. These findings align with adult cervical deformity principles: the surgeon must plan the head, neck, cervicothoracic junction, and trunk together [19-21,27,28]. The second lesson is restraint. The occiput should not be included unless pathology requires it. C2 is often enough proximally, and preserving occipitocervical motion matters. Similarly, the target is not maximal lordosis. It is a head position that allows the patient to look forward, swallow safely, ambulate confidently, and live with the fusion. In DHS, a beautiful radiograph can still be a poor result if it ignores swallowing, downward gaze, or global posture [29].

The framework proposed here is deliberately practical and explicitly unvalidated. It is not a replacement for the Ames cervical deformity classification or the SRS-Schwab adult spinal deformity system [19,27]. Rather, it is a surgeon-facing checklist built from the recurring decisions in DHS: cause, flexibility, neurological compromise, global alignment, fusion levels, and patient biology. Its purpose is to avoid common errors: fusing reversible disease, waiting until a flexible deformity becomes fixed, stopping too short distally, including the occiput unnecessarily, ignoring spinopelvic imbalance, and underestimating frailty, dysphagia, or bone quality.

A final practical issue is feasibility. Many recommendations in this review assume access to deformity imaging, neuromonitoring, experienced anesthesia, CT-based planning, and multidisciplinary swallowing or airway support. In real-world practice, especially outside large referral centers, those resources may be uneven. The safest application of this framework is not to perform every possible step everywhere, but to recognize when the case has exceeded local resources and when referral, staging, or a less aggressive correction is the better decision.

Proposed Surgical Algorithm

The proposed algorithm begins with confirmation of DHS and exclusion of mimics, followed by evaluation for medically treatable causes. It is an author-proposed, unvalidated clinical framework intended to organize decision-making rather than dictate a single treatment pathway. Early, flexible, neurologically safe cases should undergo disease-specific treatment, rehabilitation, external support, and serial reassessment. Surgical evaluation is appropriate when there is progressive deformity, disabling loss of horizontal gaze, myelopathy or radiculopathy, dysphagia, fixed deformity, severe refractory pain, or failure of structured conservative treatment.

Once surgery is indicated, the surgeon should assess flexibility, neural compression, regional and global alignment, bone quality, airway risk, and swallowing status. Flexible deformity without major anterior pathology may be treated with posterior cervicothoracic fusion. Fixed deformity, anterior compression, or anterior column collapse may require anterior release, combined reconstruction, or osteotomy. C2 is the preferred upper anchor when the craniocervical junction is stable; the occiput is reserved for true upper cervical or craniovertebral pathology. Distally, fusion should usually cross the cervicothoracic junction, with T2 as a common minimum and T3-T5 considered for higher-risk cases.

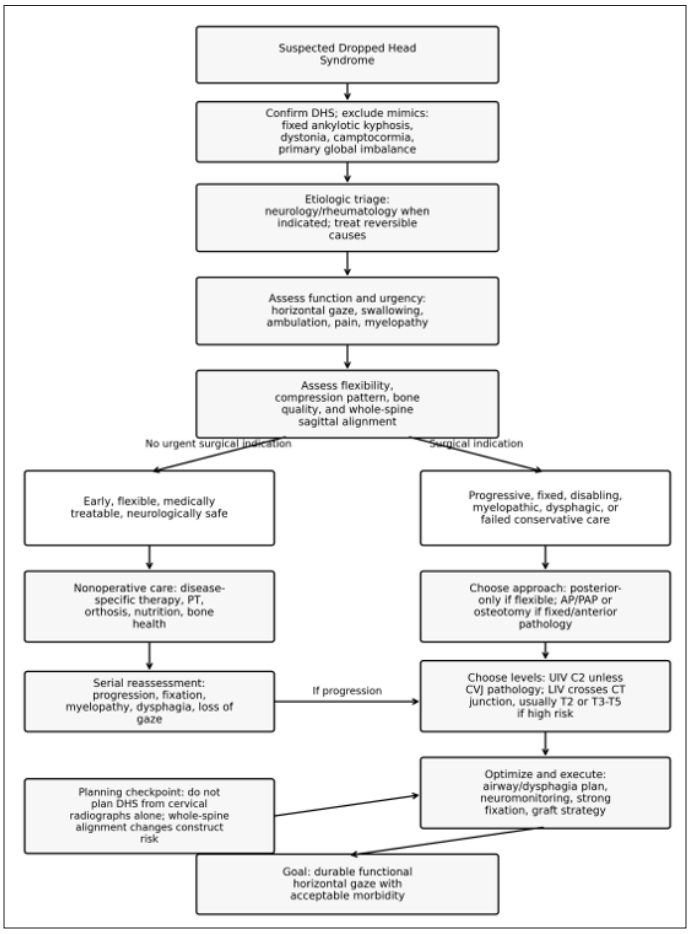

Figure 1: Proposed surgical decision-making algorithm for Dropped Head Syndrome. The algorithm moves from diagnostic triage and reversible causes to flexibility assessment, surgical indication, approach selection, fusion-level planning, and postoperative risk management

Conclusion

Adult Dropped Head Syndrome is rare, disabling, and easily recognized, but it should not be treated as a single disease. For the spine surgeon, the essential task is to determine whether the patient has a reversible neuromuscular or medical condition, a progressive structural deformity, neurological compromise, or a component of global sagittal imbalance. That distinction guides both timing and extent of treatment.

Nonoperative management remains appropriate for early, flexible, or medically treatable cases. Surgery should be reserved for progressive deformity, disabling loss of horizontal gaze, myelopathy or radiculopathy, refractory pain, dysphagia, or fixed sagittal malalignment. When reconstruction is required, success depends on careful assessment of flexibility, whole-spine alignment, bone quality, frailty, and fixation strategy. C2 is often a reliable proximal anchor when the craniocervical junction is stable, while distal fixation should generally cross the cervicothoracic junction to reduce mechanical failure.

The goal of surgery is durable restoration of functional horizontal gaze with acceptable morbidity. DHS should therefore be approached as complex cervical deformity surgery requiring individualized planning, strong fixation, biological optimization, and honest patient counseling.

Manuscript Declarations

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