Widening the Horizons of Otolaryngologist an Interdisciplinary Approach for Surgical Problems of Cervical Spine

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Abstract

Till recent past the realm of ENT surgeons was limited to tonsils and mastoids. But with the passage of time and strides made by the Biomedical Engineering, the horizon has widened and the Otolaryngology has kept pace with other medical specialities. Lesions of Clivus, cervicomedullary junction and cervical vertebra often present difficulty to the Neuro Surgeon and Orthopaedic Surgeon. The role of ENT surgeon in these cases of cervical spine surgery can be significant. A successful attempt has been made to approach various levels of cervical spine anteriorly either transorally, transpharyngeally or transcervically.

Although these techniques are well suited to the training and experience of the Head & Neck surgeon, it is our perception that the procedure is underused by the members of our speciality. Although these approaches are safe and reliable, it is not part of the Otolaryngologist's usual surgical armamentarium.

In the present study a series of thirteen patients presented between February '91 and July '94, with various pathologies of Cervical Spine with or without neurological deficits is reviewed. The surgical technique is discussed and methods to prevent potential complications and adverse sequelae are also addressed.

HISTORICAL PERSPECTIVE

The concept of an anterior approach for visualization and treatment of Anterior spinal pathology due to fractures was initially suggested by Badgley in 1939. During this period the desire to eradicate spinal infection (Pott's Disease) with an anterior approach was gaining popularity. Dr. LeRoy C. Abott was credited by Bailey and Badgley for proposing the anterior approach for the treatment of a lytic lesion involving 4th and 5th cervical vertebrae. The success of this technique provided the basis from which its application to other disorders of cervical spine like fractures, dislocation and degenerative conditions was extended.

Transoral incision and drainage of retropharyngeal abscesses was performed a life saving procedure long before the advent of antibiotics demonstrating the feasibility of this approach. Over last 35 years, transoral has become more common place and the number of applications for this surgery has steadily grown.

In this review the technique, utility of the methods of approaching various levels of cervical spine for varied indications will be discussed. Our experience with the anterior approach will be reviewed and complications discussed.

Materials & Methods

A series of thirteen patients surgically treated

for various lesions of cervical spine by anterior approach between February '91 and July '94 was reviewed. Various indications for which the patients were treated by anterior approach were as in Table-I. Most of these patients were seen by orthopaedic surgeon initially except those with Pott's spine having retropharyngeal abscess who presented to Department of Otolaryngology first.

Patients were thoroughly evaluated for the existing pathology by clinical examination and plain lateral and anteroposterior radiographs of cervical spine. Neurological deficits if any was evaluated. In selected candidates CAT scan/MRI studies were done to decide the level and extent of lesion.

It is necessary to determine the range of motion of the neck in terms of neck extension for endotracheal intubation and intraoperative position. The limits of voluntary range of motion within which the patient notes no increase in symptoms should be noted. These limits to cervical spine excursion must not be exceeded during Endotracheal intubation or patient positioning because serious and perhaps permanent neurological deficit may result from injury to a patient level of consciousness is depressed to the extent that he or she can't report subjective complains. If the limits to cervical motion preclude standard laryngoscopic endotracheal intubation awake nasotracheal or fibreoptically guided intubation should be performed.

Surgical Technique

Transcervical

After the patient is anaesthetized he or she is placed on the operation table in supine position. A small bolster such as folded towel, is placed under the upper thoracic spine between the shoulder blades so that the shoulders fall slightly away and the anterior neck is more favourably presented to the surgeon. The chin is kept either in midline or turned slightly away from surgical site. Head rotation should be minimum so as not to distort the surgical

anatomy. A small pad may be placed under the pelvis on the side from which the bone grafts will be obtained. To assist in exposure, the shoulders may be taped to the table. This will place the shoulders in a more depressed position and may assist in radiographic confirmation of the operated level. The neck, upper chest and iliac crest are prepared and draped in sterile fashion.

The incision can be made on the left or right side depending on the surgeon's preference and the location of pathology. Advocates of left sided approach believe that it's some what safer from the stand point of injury to the recurrent laryngeal nerve. This branch of vague nerve ascends in the neck between the trachea and esophagus on the either side of the midline. The right recurrent laryngeal nerve courses around the (R) subclavian artery and crosses lateral to medial to reach the midline trachea.

We approached all cases from (R) side without any damage to Recurrent Laryngeal Nerve. The position of skin incision is determined by palpation, The sixth cervical vertebrae can usually be identified by palpation of the carotid tubercle. This is generally two fingerbreadth above the clavicle. The cricoid cartilae is at C-6 level. The thyroid cartilage is found at C4-5 disc level. The hyoid bone is palpated at C3 level (Fig. 1). In one or two level disease transverse incision is used which in three or more levels the longitudinal incision is preferable because it is more easily extended rostrally or caudally. Longitudinal incision is usually along the anterior border of sternocleidomastoid muscle.

The skin is opened down to the platysma muscle. If the anterior jugular vein is large and is in the way, it can be ligated and divided at this point, otherwise it is retracted. The platysma is divided exposing the superficial cervical fascia (Fig 2a & 2b). The plane between the trachea and sternomastoid muscle may yield to blunt dissection, alternatively it may necessitate a sharp incision. Once this plane is defined, most of the sub-

Fig. 1: Site of skin incision for approaching various cervical levels. For C1-2 level the incision is made below the angle of jaw. For C3-4 level the incision is made at the level of hyoid bone, approximately 1 cm above the thyroid cartilage. For C4-6, the incision is at the level of thyroid cartilage. For C5-6, the incision is at the level of Cricoid cartilage. For C7-T1, the incision is made above the clavicle. Slight variations in level may be made to allow the placement of incision along a naturally occurring skin crease.

Fig 2a

sequent dissection can be performed using blunt dissection. The mid cervical fascia is opened with scissors (Fig. 3). In this plane the superior and inferior thyroid vessels course from carotid bundle to midline structures. If these

Fig 2b: Longitudinal Skin incision and Transverse skin incision with platysma incised longitudinally and transversely respectively.

Fig. 3: Dissection of Plane between trachea and sternomastoid muscle. Deep cervical fascia is incised.

are in way they can be ligated and divided. At this point, the plane of surgical approach continues between esophagus medially and carotid bundle laterally (Fig. 4). The spine can be easily felt with the tips of fingers at the depth of this plane. As long as the pulse of carotid artery is kept laterally palpation of the anterior spine vertebral bodies and anterior longitudinal ligament can usually be performed deep to prevertebral fascia (Fig. 5).

Once exposed, the prevertebral fascia is sharply divided. This will expose the anterior longitudinal

Fig. 4: *Plane of surgical approach between Esophagus medially and carotid bundle laterally.*

Fig. 5: *Pretracheal fascia identified and incised exposing underlying intervertebral column and longus colli muscles.*

ligament and the longus colli muscles that run parasagittally. The latter should be stripped carefully of the antero medial aspect of vertebral bodies such that a pocket is performed between the medial and posterior surface of muscles and anterior aspect of vertebrae (Fig. 6a & 6b). Fixed bladed retractors are now placed to improve the exposure and protecting the vital structures from injury.

When the prevertebral fascia has been identified and exposed, an 18 - gauge, spinal needle should

Fig 6a

Fig 6b: *Anterior vertebral column exposed for surgery at one or two levels 6b. Exposure for multilevel anterior cervical surgery.*

be inserted a short distance into the suspected disc space and a lateral radiograph is obtained for definitive identification of operative level (Fig. 7).

Once the level is confirmed the anterior longitudinal ligament and anterior annulus should be incised and disease is cleaned. In cases of prolapse disc, the disc contents are removed, in the Pott's spine, abscess is drained, granulation tissue removed and in the cases of dislocation the vertebrae repositioned. Spine is then stabilized by Iliac Crest bonegraft and fixed with metal plates (Fig 8a & 8b). Haemostasis is checked. A small penrose

Fig 7: Spinal needle inserted in suspected disc space to identify the operative level.

drain placed in prevertebral space and brought out through separate stab wound. Because tissues fall together naturally and securely deep sutures are not needed. The superficial fascia and platysma can be reapproximated with several absorbable sutures and skin closed.

Cases: Eight patients were approached by this route.

Three patients had Koch's spine, two had fracture dislocation, two had cervical spondylosis with disc prolapse and one patient had intradural extra medullary tumour.

Case : 1

Fakirbhai M/50 19193/637 presented dysphagia to solids and restricted neck movements. Examination of oral cavity revealed fullness in retropharyngeal space. Radiographically a huge retropharyngeal abscess with collapse of C5-6 cervical vertebrae was evident (C1-a). Patient did not have any neurological deficit. The abscess was drained transorally and after 4 days was taken up for surgery, wherein debridement of cervical spine C5-6 with bone grafting was done. Patient was put on antituberculous therapy after confirming histopathological report of granulation tissue. Patient stopped treatment after five months and had recurrent abscess (C1-

Fig8a : H-metal plate and screw used for fixation

Fig 8b : Metal plate in position

b). He was approached again from opposite side and after thorough debridement and fresh grafting the spine was stabilized by plate. Patient is doing well (C1-Cab).

Case : 2

Fourteen years old male patient Paresb 5307/4978 presented with tingling and numbness in right arm and wasting and weakness of right arm muscles with low grade fever and difficulty in swallowing and pain in neck. Neurological exam revealed motor wasting of supra spinatous, deltoid and arm muscles. There was

C1-a: XRay lateral view (Fakirbhai 19193/637) showing huge retropharyngeal abscess with collapse of C5-6 Cervical vertebrae.

no sensory deficit, suggestive of lower motor neurone lesion at level C5-6. XRay of cervical spine revealed erosion of C4-5. Patient was approached transcervically and anterior decompression and debridement of C4-5 was done. Spine was stabilized with bone grafting and H-plating (C2 a&b). Neurological deficit recovered completely in period of 4 months. Patient was kept on Antituberculous therapy.

Case : 3

Laxman male-40 19682/10800 had sustained head injury following which he had traumatic paraplegia due to dislocation of C6-7 (C3- a). After traction and reduction patient was taken for surgery. By transcervical approach C6-7 vertebrae were stabilized with bone graft and

C1-b: Recurrent Abscess with Bone graft in position

fixed with H-plate (C3-bc). Patient recovered completely after three months.

Case : 4

Ravjibhai M-42, 5042/4767 presented with tingling and numbness and weakness of upper limbs following fall from height. XRay cervical spine revealed displacement of C3-4 (C4-a). After traction and reduction patient was taken up for surgery. By transcervical approach the vertebrae were stabilized, discectomy was done and after bone grafting, H-plate fixation was done (C4-b&c). Patient recovered completely post operatively after 5 months.

Case : 5

Jayaben F/29 23222/338 presented with paraparesis of one months duration without any

C1-Cab: Post operative XRay a & b with plate in position

sensory disturbance. XRay cervical spine suggested Koch's C7T1. Patient was approached transcervically from right side. Thorough debridement of C7T1 was done followed by Bone grafting and stabilization of spine with H-plate (C-5a&b). The histopathological report of granulation tissue from spine suggested change of tuberculous. Patient was put on antituberculous therapy. Patient is improving gradually from paraplegia.

Case : 6

Rosy Ouseph Female aged 48, 20892/4198 presented with pain in lower extremities, tingling and numbness which progressively increased over a period of six months to upper extremities as well. She admitted with tingling and numbness in all extremities with restriction in all routine activities. Patient's XRay revealed changes of cervical

C2-a

spondylosis (C-6-a). She was subjected to MRI which revealed posterior herniation of C5-6 inter vertebral disc with significant extradural compression of cervical cord and exiting nerve roots (C-6-b).

She was approached transcervically and discectomy was done. Fixation and stabilization of spine was accomplished. Patient improved satisfactorily over period of three months following surgery.

Case : 7

Dudhabhai M/50, 14682/8251 presented with quadraparesis of extremities following fall. XRay cervical spine was suggestive of disc lesion C5-6. Patient was advised cat scan with contrast, but was not affording. Patient was taken up for surgery by transcervical approach. Intraoperative findings suggested subluxation of C5-6 with avulsion of C5 vertebral body

anterioinferiorly. Discectomy with bone grafting and plating of C5-6 was done via anterior transervical approach. Patient recovered completely over six months period.

Case : 8

Vilashben F-15, 26516/1246, presented with progressively increasing weakness of all four extremities over a period of one year. Myelography revealed intradural extramedullary tumor at C6/T1 level. Patient was taken up for surgery by transcervical approach. Soft whitish well encapsulated tumor was dissected out. The histology was suggestive of benign Neurilemmoma.

After excising tumor the spine was bone grafted and stabilized with wiring. Patient was doing well post operatively but on twelfth day suddenly she had cardio respiratory arrest and she collapsed.

Transhyoid Transpharyngeal Approach

C3-4-5 levels were approached by this route in three patients. The patients head is hyperextended with the anaesthesia administered through the tracheostomy tube. A transverse incision is made at the level of hyoid bone from anterior border of one sternomastoid to the other (Fig 9) and subplatysmal muscles are cut above the hyoid bone after identifying and preserving lingual arteries. Pharynx is opened in vallecula (Fig 10) and pharyngeal mucosa is incised parallel to vertebral process and space reached. Diseased disc tumor and bone may be removed with ease under direct vision. The resultant cavity is filled with bone graft from iliac crest.

The posterior pharyngeal wall is meticulously closed in layers with O Chromic catgut on an

C2b : Post operative XRay AP & Lat film (Paresh 5307/4978)

C3a: Lateral XRay (Laxman 19682/10800) showing Dislocation of C6-7

Fig 9: Incision for Transhyoid approach

atraumatic needle. The muscles are sutured back and skin closed in layers after soft rubber corrugated drain is inserted (Fig 11). After surgery patient is nursed on nasogastric tube for 4-7 days.

All patients were placed on 5-7 days course of perioperative and post operative antibiotics. Liquids were started four hours of surgery and normal diet resumed after a week when nasogastric tube is removed. A post operative radiograph is obtained to see the position of graft and plate.

Cases :

Three patients were approach by the route. Of the three, two had tuberculosis of cervical spine and one had benign tumor of laryngopharynx.

C3b: Lateral film (19682) showing reduction of displaced vertebrae

C3c: Fixation of C6-7 with H-plate post operative film.

C4a: Lateral film (Ravjibhai 5042/4767) showing displaced spine C3-4

Fig 10: Subplatysmal muscles cut above hyoid bone and pharynx opened in vallecula.

C4-c: Postoperative film showing spine stabilized with H-plate.

C5-a

C6-a Lateral film showing changes of cervical spondylosis (Rosy Ouseph 20892/4198)

C5-b: Post operative AP & Lateral films (Jayaben 23222/338) of cervical spine fixed with H-Plates.

C6-b: MRI - showing disc herniating posteriorly at C5-6

Fig 11 : Pharynx sutured back in layers

C9-a: Retropharyngeal Abscess with destruction of C3-4-5 (Kamalaben 530/1837)

C9-b: Post operative lateral film showing plate in position.

Case : 9

45 years old female patient named Kamalaben 530/1837 presented with difficulty in swallowing and restricted neck movements. Clinical examination revealed fullness in posterior pharyngeal wall. XRay cervical spine revealed retropharyngeal, abscess with destruction of C3-4-5 vertebrae (C9-a). The abscess was drained transorally and patient was kept on Ryle's tube feeding. Five days later patient was taken for surgery. By midline pharyngotomy, the pharynx was opened and C3-4-5 vertebrae were approached. After thorough debridement bone grafting and plating the wound was closed (C9-b). Patient was kept on Nasogastric feeding for a week till pharyngeal mucosa healed. Later patient was put on antituberculous therapy after confirmation of histopathological report.

Case : 10

Galabhai M/45, 3240/1142, presented with discomfort in throat while swallowing. Indirect laryngoscopy revealed a smooth swelling on laryngeal surface of epiglottis. Biopsy from swelling revealed fibrofatty tissue with changes of non-specific inflammation. Patient was then lost for follow up. After eight months patient again presented with progressively increasing dysphagia and difficulty in breathing. Patient had to be tracheostomized because of airway obstruction. Nasogastric tube was passed. Plain XRay and Ba-Bolus revealed a well defined mass in laryngopharynx and upper esophagus (C10-a). MRI and catscan revealed well capsulated mass without destruction of surrounding structures (C10-b-c-d). Patient was approached transpharyngeally via midline pharyngotomy and mass was excised

in toto. Mass was well capsulated (C10-c). A week later the tracheostomy was closed and nasogastric tube was removed. Patient had normal voice and deglutition on follow up without any recurrence. Biopsy revealed a fibrofatty mass.

C10-a: Lateral film (Galabhai 3240/1142) showing laryngopharyngeal mass causing airway obstruction with Tracheostomy in position.

C10b-c-d: MRI & Cat Scan showing well capsulated mass on pharynx

C10-e: Specimen removed transpharyngeally

Case : 11

Female patient Shantaben aged 55 years presented with difficult in swallowing low grade fever and weight loss of two months duration. Clinically examination and indirect laryngoscopy revealed a smooth bulge over posterior pharyngeal wall. XRay cervical spine revealed retropharyngeal abscess with destruction of C3-4 cervical vertebrae (C11). Abscess was drained under local anaesthesia transorally. Ryle's tube was passed and later patient was taken for surgery wherein the spine was approached by midline pharyngotomy. After thorough debridement the spine was stabilized with bone graft and fixed with X-plate. Biopsy revealed changes of tuberculosis. Patient was put on antituberculous therapy.

Transoral

In two patients the upper cervical spine C1-2-3 was approached by transoral technique as described by Saffouri and Ward. The patients were tracheostomized under local anaesthesia and then anaesthetized through tracheostoma. The skin is prepared with betadine and spirit and head and neck are draped. A Boyle davis mouth gag is placed in mouth (Fig11a-b). The hypopharynx is packed. The posterior pharynx is incised parallel to vertebral anterior processes. Mucoperiosteum flap are elevated laterally to expose vertebral

C11-a: Lateral Xray (Shantaben) showing retropharyngeal abscess with destruction of C3-4 cervical vertebra

and intervertebral disc. Soft palate was split in midline in one of the patients for better exposure of C1 in case of traumatic dislocation.

After clearing disease and stabilizing spine the posterior pharyngeal wall is closed with interrupted O chronic catgut on an atraumatic needle.

Case 12 & 13

Two male patients M-28 & 30 years respectively presented with weakness of all four extremities of sudden onset following whiplash type of injury. Xray revealed dislocation of C12. Patients were taken for surgery and cervical spine was approached by transoral route using Boyle davis mouth gag. In one patient the soft palate was split for better access. After reduction of dislocation the spine was stabilized by plate.

Fig11a

Fig11b: Transoral approach to upper cervical spine C1-2-3

One of the patients died suddenly on the same day in evening because of cardio respiratory. The other patient recovered completely over period of six months.

Observations and Results :

We have used anterior approach to cervical spine in a consecutive series of thirteen patients which comprised of eight males and five females. The age ranged from 15-55 yrs. Most of these patients presented to Orthopaedic surgeons initially except 3 patients with retropharyngeal abscesses secondary to tuber-

Fig12: Important structure coming in relation to upper cervical spine

culosis of spine who presented to ENT surgeon. All the patients were jointly treated by otolaryngologists and orthopaedic surgeon. Transcervical approach provided anterior access to the body of third to seventh cervical vertebrae without the need for posterior dissection of carotid sheath. It also provided adequate exposure for the insertion of iliac grafts which was necessary in nine patients. This approach gave excellent exposure for discectomy bone grafting and fixing the spine in two patients with cervical disc, anterior debridement and fixation of C5-6 vertebrae for treatment of Koch's spine in three patients, excision of extra medullary tumor at C5-6-7 in one patient and reduction of dislocation C3-4 and C5-6 secondary to unstable fracture in two patients.

Two patients with retropharyngeal abscess and one patient with benign laryngopharyngeal tumor were approached via midline pharyngotomy and spine was stabilized with bone grafting and plating after debridement while two patient with C1-2 dislocation were approached transoropalatally.

There were no infections in transmucosal approach. Of thirteen patients, nine patients had some degree of neurological deficit varying

Table I
APPROACH

Indications	Transcervical	Transpharyngeal	Transoral	Total
Koch's Spine	3	2		5
Disc Lesion	2			2
Tumor	1	1		2
Trauma	2		2	4
Total	8	3	2	13

from mild muscle wasting to complete paraplegia or quadriplegia due to existing pathology. All these patients recovered completely from the neurological deficit over a period of 6-8 weeks. No patients had any iatrogenic neurological deficit of the spine in the present series.

Operative complications were nil except for two patients who died following surgery - one within 24 hours due to sudden cardio respiratory arrest and other twelve days due to unknown reason.

Reoperation was necessary in one patient of tuberculosis of spine who had stopped Anti tuberculous drugs and later had recurrent retropharyngeal abscess.

Patients returned to normal diet the next day except those patients who were approached transorally or transpharyngeally. These patients were kept on Nasogastric feeding for a period of week till pharyngeal mucosa healed.

Patients without neurological deficit were active within a week. Eleven patients who were followed for a year or more had solid anterior fusion and no subsequent loss of cervical stability. Pain in neck was relieved and complete neurological recovery was observed after varying period of 6-8-10 weeks.

Discussion:

The major advantage of anterior approach are

- (1) Direct visualization of pathology and the necessity to manipulate any neurologic element.
- (2) Segment is stabilized adequate.
- (3) Access to midline.

The transoropalatal approach provided a direct reliable and safe route to upper cervical/clival region. It has become procedure of choice to correct wide array of pathological processes that are amenable to decompression and fusion procedures.

The lower level C2-3-4 can be approached easily via midline pharyngotomy particularly in patients with retropharyngeal abscess after incision and drainage of abscess. No important structures are encountered in this approach.

The disadvantage of transmucosal approach is that oropharyngeal incision may predispose the patient to an unacceptably high risk of graft infection although it has not been observed in any of our four cases. Thus transoral and pharyngeal surgery should be limited to resection of bone and soft tissue without grafting except in cases of abscess. Another major disadvantage is that patients have to be maintained on nasogastric feeding for a period of week to 10 days till the mucosa heals.

The anterior retropharyngeal approach is an alternative procedure that offers the advantage of avoiding the oral cavity altogether resulting in lower incidence of infection. Also patient can resume normal oral diet the next day. It is very helpful in approaching all levels from C4 to C7. This method if used for upper cervical spine C1-3 may pose risk to various vital structures like vertebral A, marginal mandibular N, hypoglossal N and superior laryngeal N. Also it is almost impossible to get to the level of the axis and atlas (Fig. 12) because the parotid gland branches of external carotid A and the VII, IX, X and XII Nerves obstruct the view. At this level the Internal carotid Artery and internal jugular vein are fixed to the base of skull and it's dangerous to retract these structures with force. The mandible is also in way. On other hand, the front of spine is separated from pharynx by only a thin layer of tissue composed of pharyngeal mucosa, constrictor muscle, buccopharyngeal fascia and prevertebral muscles.

Hall et al described splitting of mandible and tongue to facilitate exposure from clivus to C2. We have not found this technique to be necessary.

The two disadvantages of lateral retropharyngeal approach for upper cervical spine are

- (1) **The anterior decompression of spinal cord is more difficult in that it provides a lateral rather than a more direct anterior visualization of vertebral bodies.**
- (2) **The narrow interval makes it more difficult to insert a strut graft.**

Conclusions

Although the transoral and transcervical approach to upper and lower cervical spine has been used increasingly over last 25 years, the indications and techniques are unfamiliar to many Head and Neck surgeons and it is our

perception that the procedure is under used by the members of our speciality.

The number of operations described is too small to conclude but the exposure was excellent and tissue trauma was less compared to tongue splitting approach described by Hall et al with decreased rate of infection.

The transoropharyngeal approach is safe and direct route that provides excellent exposure to upper cervical spine whereas lower spine can be safely approached by anterior retropharyngeal approach.

The Head & Neck surgeon's role is to provide quick and wide exposure of required area with minimal resultant postoperative deficits.

Though there is an advantage of good exposure making orthopaedic surgeons work easier, neither of these approaches should be undertaken lightly. The seriousness and severity of complications resulting from these procedures should be kept in mind.

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