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Original article

Management of post-traumatic neglected cervical facet dislocation

Vinay Prabhat *, Tankeshwar Boruah, Hitesh Lal, Ramesh Kumar, Ashish Dagar, Harekrushna Sahu

Central Institute of Orthopaedics, Vardhaman Mahavir Medical College and Safdarjung Hospital, New Delhi, India

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ABSTRACT

Background: Post-traumatic unilateral or bilateral sub-axial cervical spine dislocations with locked facets are quite common. In developing countries like India, many patients with cervical injuries report late due to many reasons like rural backgrounds, lack of infrastructures and skilled surgeons, unawareness, poor socioeconomic status, lack of transportation to the specialized center with proper facility, etc. Early management is essential to maximize better neurological outcome. Delayed or neglected presentation makes treatment more challenging. Very few literatures are currently available regarding management of neglected cervical facet dislocation but no one offers clear cut management. Purpose of our study is to evaluate treatment outcome of 15 patients with post-traumatic neglected cervical facet dislocation.

Here we have reviewed 15 patients with post-traumatic neglected presentation of cervical facet dislocations and evaluated their treatment outcome.

Materials and methods: This is a retrospective type of study done in spine care unit of VMMC and Safdarjung Hospital, New Delhi from July 2013 to June 2016. Record of 15 patients with neglected cervical dislocation who were undergone anterior cervical discectomy and fusion along with posterior lateral mass screw fixation depending upon close reduction and integrity of disco-ligamentous complex.

Results: 15 patients were included in this study. 4 patients underwent only anterior cervical discectomy and fusion (ACDF) after complete close reduction with intact disco-ligamentous complex. Remaining 11 patients who failed to achieve complete reduction or had posterior disco-ligamentous injuries underwent posterior partial facetectomy and lateral mass screw fixation with anterior discectomy and fusion concomitantly. Mean follow up period was 14 months. All patients achieved pain relief and sufficient neck movements. 1 patient with only nerve root injuries recovered completely. 6 out of 11 patients with incomplete spinal cord injuries, improved by one Frankel grade and remaining 5 patients by two grades. 3 patients with complete quadriplegia showed no clinical and neurological improvement.

Conclusion: Proper decompression, reduction and fixation should be done in neglected cervical dislocation as it provides mechanical stability and alignment, facilitates rehabilitation, prevent kyphotic deformity as well as offers a fair chance of neurological recovery.

1. Introduction

Post-traumatic cervical injury is a very devastating event on personnel, family level as well as financial burden to the society because of morbidity, prolonged treatment, rehabilitation and life-long dependence.[1] Most common etiologies resulting in cervical spine injuries included are fall from height and road traffic accidents. Unilateral or bilateral sub-axial cervical spine dislocations with locked facets are quite common. In developing countries like India, many patients with cervical injuries report late due to many reasons like rural backgrounds, lack of infrastructures and skilled surgeons, unawareness, poor socioeconomic status, lack of transportation to the specialized center with proper facility, etc. Early management is essential to maximize better neurological outcome. Delayed presentation makes treatment more challenging.[2] Very few literatures are currently available regarding management of neglected cervical facet dislocation but no one offers clear cut management.[2–6] Management includes conservative treatment and surgery. Recently incidence of operative

* Corresponding author at: c/o J. N. Singh Qt no-B130 (T), Po-Dhurwa, Ranchi, Jharkhand 834004, India.
E-mail addresses: vinay.prabhat@rediffmail.com (V. Prabhat), drboruaht@gmail.com (T. Boruah), drhiteshlall@gmail.com (H. Lal), kumarramesh@gmail.com (R. Kumar), dagarash@gmail.com (A. Dagar), hksahu86@gmail.com (H. Sahu).

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reduction, decompression and fixation has increased as it provides better mechanical stability and alignment, facilitates rehabilitation and increases chances of neurological recovery.

Here we have reviewed 15 patients with post-traumatic neglected presentation of cervical facet dislocations and evaluated their treatment outcome.

2. Materials and methods

This is a retrospective type of study conducted in Central Institute of Orthopaedics, VMMC and Safdarjung Hospital, a tertiary care center in northern India. In this study, we have evaluated treatment outcome of patients presented with neglected cervical facet dislocation. Records of 11 men and 4 women aged 18–50 (mean = 33) years who presented with unilateral (n = 5) or bilateral (n = 10) cervical facet dislocation with a delay of 31–193 days (mean = 63 days) days were reviewed. The etiologies leading to cervical injury were falls from height (n = 12), road traffic accidents (n = 2) and fall of heavy object over head (n = 1). The most common level of dislocation was C5–C6 (n = 7), followed by C6–C7 (n = 3), C3–C4 (n = 2), C4–C5 (n = 2) and C7–T1 (n = 1).

Proper general examination and neurological examination including muscle tone, sensory, motor, deep tendon reflexes, sacral sensation, and bulbocavernous reflexes were done. The neurological status was graded according to the Frankel classification. 3 patients had complete quadriplegia (grade A), 11 had

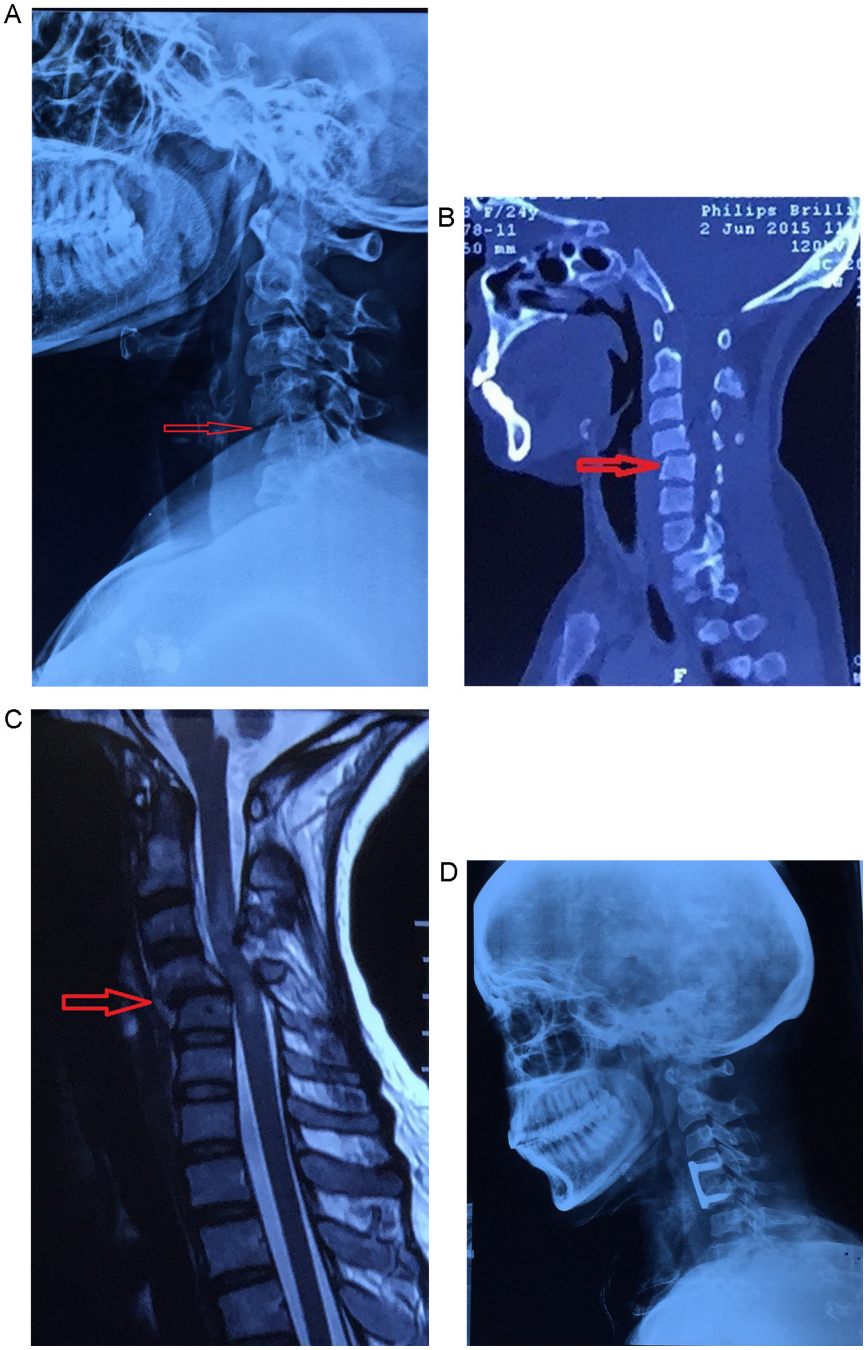

Fig. 1. (A) Lateral view of cervical spine showing anterolisthesis of C4 vertebra over C5 with facet dislocation. (B) Sagittal section NCCT of cervical spine showing anterolisthesis of C4 vertebra over C5 vertebra without fracture of vertebral body. (C) T2 image MRI of cervical spine showing compression of spinal cord by extruded disc at C4–C5 level with myelopathic changes of spinal cord. (D) Post-operative lateral view of cervical spine showing cervical plate and screw with intervertebral tri-cortical iliac crest graft with good alignment and reduction.

incomplete spinal cord injury (grades B and C), and 1 had only nerve root injury. Routine hematological investigations, radiography, computed tomography, and magnetic resonance imaging of the cervical spine with screening of whole spine were performed in all patients.

2.1. Preoperative radiograph, computed tomogram and MRI: Figs. 1A–C and 2A–C

Closed reduction was attempted using Crutch field tong skull traction. Traction weight was initiated at 4 kg and increased gradually to a maximum weight according to affected vertebral level. Neurological status was monitored during the course. After achieving complete close reduction, the traction weight was reduced by 50%.

In patients who had achieved complete closed reduction and with intact posterior ligamentous complex, only anterior cervical discectomy and fusion (ACDF) was performed. Those patients who had failed to achieve complete closed reduction or had posterior ligamentous injuries underwent combined procedure including posterior partial unilateral/bilateral facetectomy and lateral mass screw fixation along with anterior cervical decompression and fixation simultaneously. In combined procedure, staged procedure with anterior–posterior–anterior approach was used. In first stage, only anterior decompression were done to remove extruded disc in order to achieve slight mobility and prevent neurological deterioration during reduction in second stage after partial facetectomy. In second stage, posterior partial facetectomy, reduction and lateral mass screw fixation were done. In third stage, insertion of tri-cortical iliac crest graft and cervical plating were done. Traction

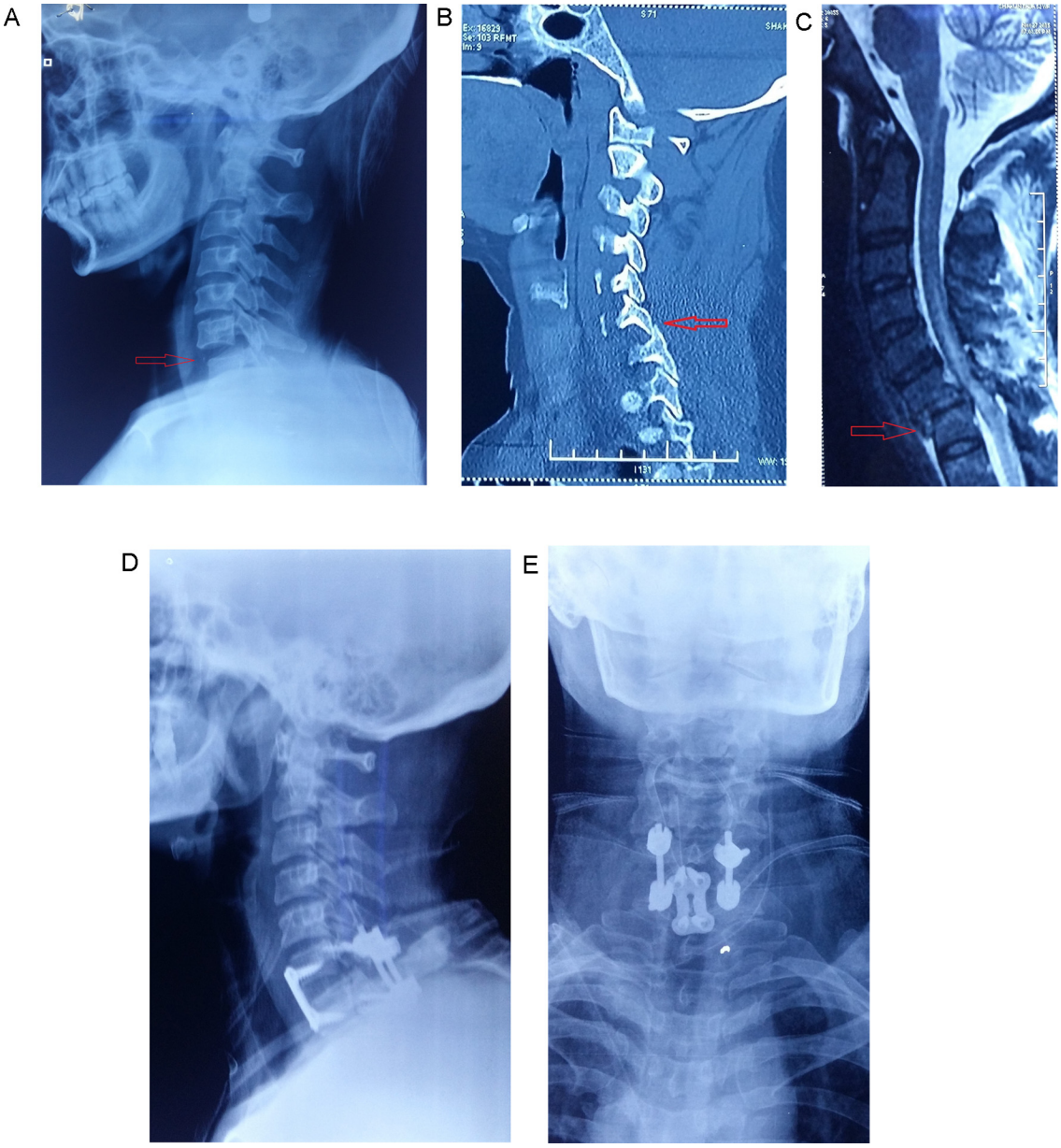

Fig. 2. (A) Lateral view of cervical spine showing anterolisthesis of C6 vertebra over C7 with facet dislocation. (B) Sagittal section NCCT of cervical spine showing anterolisthesis of C6 vertebra over C7 vertebra with perched facet. (C) T2 image MRI of cervical spine showing compression of spinal cord by extruded disc at C6–C7 level with increased inter-spinous space, damaged posterior ligamentous complex and myelopathic changes of spinal cord. (D) Post-operative lateral view of cervical spine showing cervical plate and lateral mass screw with intervertebral tri-cortical iliac crest graft with good alignment and reduction. (E) Post-operative antero-posterior view of cervical spine showing cervical plate and lateral mass screw.

Table 1
Preoperative detail.

Serial no	Age/sex	Mode of injury	Level of injury (dislocation)	Delay between injury and admission (in days)	Frankel grade on admission	Investigations	Type of facet dislocation	Status of reduction after Crutch field tong application
1	26/M	Fall from height	C5–C6	45	B	Plain X-ray, NCCT and MRI	Unilateral	Achieved
2	25/M	Fall of heavy object	C5–C6	31	C	"	Bilateral	"
3	28/F	Fall from height	C3–C4	49	B	"	"	Not achieved
4	35/M	"	C5–C6	34	A	"	Unilateral	Achieved
5	30/M	"	C4–C5	65	B	"	Bilateral	Not achieved
6	18/M	"	C4–C5	35	A	"	Unilateral	Achieved
7	35/M	"	C5–C6	41	E (only C6 root injury)	"	Bilateral	Not achieved
8	40/M	"	C5–C6	47	C	"	Unilateral	Achieved
9	50/M	"	C5–C6	64	B	"	Bilateral	Not achieved
10	45/M	RTA	C6–C7	193	B	"	"	"
11	36/F	"	C5–C6	69	B	"	Unilateral	"
12	36/M	Fall from height	C3–C4	95	C	"	Bilateral	"
13	28/F	"	C6–C7	60	B	"	"	"
14	36/M	"	C7–T1	48	A	"	"	"
15	30/F	"	C6–C7	75	B	""	"	"

was given intra-operatively which helped in achieving mobilization, reduction and lordosis of cervical vertebra.

Data were collected and analyzed for age, gender, mode of injury, neurological levels of injury, preoperative sensory and motor power scoring, involvement of bladder and bowel, sacral and deep tendon reflexes, numbers of days elapsed before admission, type of surgical procedure, operative time, intraoperative blood loss, intraoperative and postoperative complications, post-operative neurological status, neurological status and recovery in follow up period. All pre-operative (Table 1) and operative detail (Table 2) were collected and recorded. A standardized neurological examination form was used in our study. The information collected included manual muscle test scores of all key muscles, sensory examination of pin prick and touch, sacral and deep tendon reflexes, and muscle tone evaluation. The Frankel grade, motor scores, and neurologic level were also noted.

2.2. Post-op radiograph: Figs. 1D and 2D, E

Postoperatively, the neck was immobilized with SOMI Brace, which was removed after six weeks. Intensive physiotherapy/rehabilitation was started early.

Patients were followed up at 1, 3, 6, and 12 months, and yearly thereafter. In follow up periods, proper neurological examination including muscle tone, sensory, manual muscle power, sacral and deep tendon reflexes, neurological recovery, status of bladder and bowel involvement were done. Radiography and computed tomography were also done to assess bony fusion in follow up.

3. Results

Our study included 15 patients (male 11 and female 4) with neglected cervical facet dislocation. Close reduction was achieved

Table 2
Operative procedure and follow up detail of patients.

Serial no	Procedure done	Graft	Operative time (in h)	Intraoperative blood loss (ml)	Complication (intraoperative and post-operative)	Immediate post-op neurological status	Neurological improvement in follow up (in grade)
1	ACDF (anterior cervical decompression and fixation)	Tri-critical iliac crest graft	2	250	No complication	Same as pre-operative	2 (B–D)
2	ACDF	"	2.5	200	"	"	1 (C–D)
3	Combined procedure (ACDF + lateral mass fixation)	"	5	400	"	"	1 (B–C)
4	ACDF	"	2	250	"	"	0 (A–A)
5	Combined procedure	"	4.5	450	"	"	2 (B–D)
6	ACDF	"	1.5	100	"	"	0 (A–A)
7	Combined procedure	"	4.5	500	"	"	Complete recovery (E)
8	"	"	4	400	"	"	1 (C–D)
9	"	"	5	500	Tracheostomy done in post-op 8th day	"	1 (B–C)
10	"	"	5.5	550	No complication	"	1 (B–C)
11	"	"	5	400	"	"	2 (B–D)
12	"	"	4.5	450	"	"	1 (C–D)
13	"	"	4.5	500	"	"	2 (B–D)
14	"	"	4	500	'	"	0 (A–A)
15	'	"	5	550	"	"	2 (B–D)

in 5 out of 15 patients. Only anterior cervical decompression and fusion (ACDF) were done in 4 patients who had achieved complete close reduction and had intact disco-ligamentous complex; while combined procedure (ACDF with posterior partial facetectomy and lateral mass fixation) was done in 1 patient in which close reduction was achieved but had disrupted posterior disco-ligamentous complex. Same combined procedures were done in 10 patients in which complete close reduction were not achieved. Average operative time was 2 h (range 1.5–2.5 h) in ACDF, while it was 4.7 h (range 4–5.5 h) in combined procedure. Average intra-operative blood loss was 200 ml (range 100–250 ml) in ACDF while it was 470 ml in combined procedure (range 400–550 ml). No complication had occurred intra-operatively. In post-operative period, assisted ventilation was needed in 4 patients. No neurological deterioration was seen postoperatively. Only one patient required tracheostomy postoperatively.

The mean follow-up was 14 (range, 3–32) months. All patients achieved pain relief and sufficient neck movement for normal activities. There were no graft-related problems. No patients developed neurological deterioration in follow up period. 1 patient with nerve root injury improved completely. 5 out of the 11 patients with incomplete spinal cord injury improved by two Frankel grades, and the remaining 6 by 1 grades. 3 patients with complete quadriplegia showed no neurological improvement.

4. Discussion

Close reduction, early decompression and fixation of cervical spine injuries patients are crucial for better neurological outcome. In developing country like India, many patients with cervical injury does not undergo decompressive surgeries within golden hours (6–72 h) due to various reasons like lack of infrastructures, awareness and experienced surgeon, poor socioeconomic status, conservative trials, illiteracy, etc. By the time, they report it is too late. Success rate of closed reduction for dislocations in patients presenting after 72 h is approximately 20%, compared with 64% in fresh dislocations.[6] It also varies in unilateral and bilateral dislocations. Most late-presenting patient failed to achieve closed reduction after traction using even after maximum weight of 40 lbs.[6] Reduction was then stabilized by anterior fixation with a plate, and thus avoiding posterior surgery. In patients with cervical facet dislocation with concomitant disc herniation, neurological deterioration can occur during traction. Nonetheless, no neurological worsening has ever been documented following closed reduction in awake, cooperative patients even if there is disc herniation.

Decompression of spinal cord should be done as early as possible preferably within 72 h of injury to achieve maximal neurological recovery. Levi et al. concluded that early surgery (<72 h after spinal cord injury) was the best method of managing cervical spinal cord injury.[7] Aebi et al. found that patients whose cervical dislocations were reduced early, less than 6 h post-injury, had improved neurologic recovery over later reductions.[8] Miller et al. found that if a cervical reduction was achieved by traction within the first 8 h of injury, greater neurologic recovery ensued compared with a similar group of age- and injury-matched control patients with cervical reductions longer than 8 h post-injury.[9]

Chances of neurological recovery decrease as more time elapses. The sequence of pathologic changes in neural tissue is known to progress rapidly within the first 8 h of injury,[10,11] and if surgery is hoped to improve neurologic function, it may be best to carry it out soon after spinal cord injury and before neuropathic changes have been established.[7] Many patients usually report very late to the tertiary care center with proper facility for spine injury patient. However in developing country like India, decompressive surgeries are usually not feasible due to various reasons like lack of infrastructures, skilled surgeons, poor socioeconomic status, and conservative trials, etc.

Shrivastava et al. concluded that even in late reported cases, decompression should be attempted, as it offers a best chance for a favorable neurological outcome, even in posttraumatic cases where there is no evidence of cord transactions.[12]

Posterior and anterior surgeries should be mandatory for cervical facet dislocations. Type of surgical procedure (only anterior cervical decompression and fixation, only posterior cervical fusion or combined anterior and posterior) depends on post-traction reduction status of cervical vertebrae, cervical disc prolapse, integrity of disco-ligamentous complex and medical condition of the patients. Basu et al. have suggested an algorithm showing management protocol of neglected cervical facet dislocation (Fig. 3). Surgery should not be done in unconscious, medically unfit, complete spinal cord transection with multiple co-morbid conditions, or in patients with life expectancy less than 6 months. Antero-posterior procedure for neglected traumatic bilateral facet dislocation of the sub-axial cervical spine can achieve sagittal alignment with less risk of iatrogenic neurological injury, reduced operating time, decreased blood loss, and a shorter hospital stay.[5] In addition, it enables anatomic reduction for old distractive

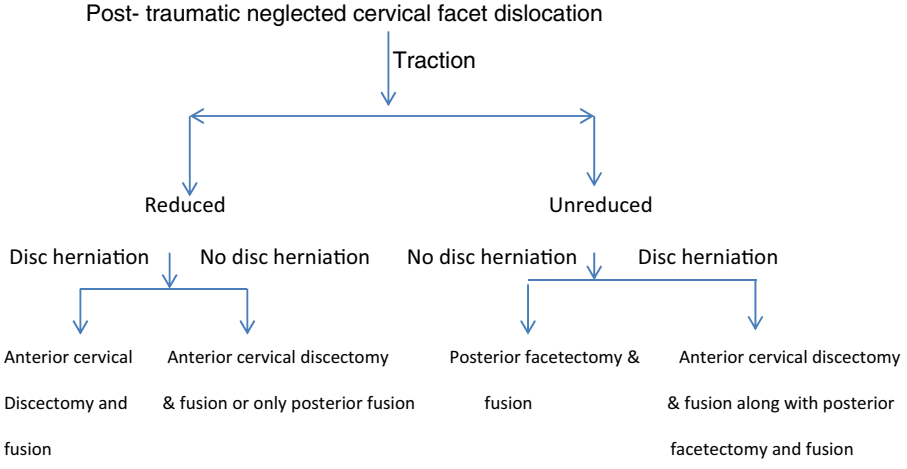

Fig. 3. Algorithm showing management protocol of neglected cervical facet dislocation.

flexion injury of the sub-axial cervical spine.[13] In terms of neurologic recovery, patient outcome, and pseudarthrosis; either an anterior or posterior surgical approach is safe as well as effective for traumatic cervical injuries associated with neurologic injury.[14] Posterior–anterior–posterior approach may be appropriate for patients with delayed presentation of bilateral dislocation of facets except when complicated by extruded disc where an anterior posterior anterior approach may be more suitable.[15] Cervical decompression and fusion surgeries are associated with varied complications including hemorrhage; wound hematoma, damage to carotid and vertebral arteries, recurrent laryngeal nerve, esophagus, trachea, duramater, infection and trauma to spinal cord leading to neurological deficit and phrenic nerve palsy. However higher rate of dysphagia is associated with combined anterior and posterior approaches compared to only anterior or only posterior cervical fusion surgery.[16]

In our series, patients who had achieved close reduction were successfully treated with the anterior approach alone, which is technically less demanding. In cases of failed closed reduction, posterior approach was used for partial unilateral or bilateral facetectomy and lateral mass screw fixation with anterior discectomy and fusion simultaneously in order to achieve improved neurological outcome, better mechanical stability and to facilitate rehabilitation.

5. Conclusion

Proper decompression, reduction and fixation should be done in neglected cervical dislocation as it offers a fair chance of neurological recovery, provides mechanical stability and alignment, facilitates rehabilitation and prevents kyphotic deformity.

Conflicts of interest

The authors have none to declare.

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