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A Brief Study On Clinical Outcome following Anterior Cervical Decompression And Fusion With Locking Anterior Cervical Plate

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ABSTRACT

INTRODUCTION:*When a neurological deficiency is present in cervical spinal injuries, it can have a severe effect and increase morbidity and death. Five percent of trauma patients have spinal injuries, with cervical spinal injuries accounting for more than half of these cases. The focus of this study is the analysis of the functional result and cervical spine injury recovery treated with locking titanium anterior cervical plate stabilization and anterior cervical decompression and fusion for sub-axial cervical spinal injuries.*

MATERIALS AND METHODS*: This retrospective study, which was carried out between January 2021 and January 2022, comprised 20 patients with neurological deficits resulting from cervical spine injuries who were hospitalized at the orthopaedic department of Saveetha Medical College Hospital in Chennai. Fracture dislocation and subaxial cervical fracture were the only two conditions for inclusion. Multiple spine injuries and SCIWORA (Spinal Cord Injury without Radiological Abnormalities) were the exclusion criteria. Five of the twenty cases involved complete spinal cord injuries, whereas the other fifteen cases involved incomplete injuries. ASIA grading was used to evaluate each case's clinical status before surgery. Open mouth, lateral, X-ray, oblique, swimmer's lateral views, CT, & MRI scans were also performed, and the results were recorded. The treatment that was carried out involved fusion, anterior cervical decompression, and stability utilizing a locking titanium anterior cervical plate. Following the tenth day of suture removal, patients are discharged from the hospital based on their improved neurological condition. In the sixth and twelfth weeks, flexion and extension X-rays are used to evaluate the fusion. If solid fusion is observed, the collar is taken off, and gradual neck motions are initiated. For the first six months, the patient is checked monthly; after that, they are examined every two months, and finally, every six months.*

RESULT: *Our study's most prevalent age group was 25 to 35 years, comprising 10 (or 50%) of the patients. The minimum age in the current research was 19 years. The maximum age in the current research was 68 years. The mean age in the current research was 32.2 years (Range between 19 to 68 years). No patients were lost to follow-up in our study. There were 12 males (60%) and 8 females (40 %). Traffic accidents account for the majority of injuries (55%) while accidental falls account for 25% of injuries. Thirteen patients (65%) in the present study group have partial spinal cord injuries, such as ASIA grades B and C. Just five patients—or 25%—had a total spinal cord injury.*

CONCLUSION: *Neurological recovery is facilitated by surgical decompression and fusion combined with stabilization, particularly in cases of partial cord damage. Overall, for anterior cervical decompression, acute sub-axial cervical spinal injuries, and fusion using a tri-cortical iliac graft is a safe technique with a high incidence of pain alleviation, functional improvement, and neurological recovery. By employing locking anterior cervical plating, grafting problems such as graft failure and kyphotic deformity were decreased, and the fusion rate was increased. In our series, there was no plate and graft or screw failure. Young age with partial lesion healed rather well.*

Keywords: *Sub axial spinal fracture; Sub axial spinal dislocations; locking anterior cervical plate; anterior cervical decompression and fusion.*

INTRODUCTION:

When a neurological deficiency is present in cervical spinal injuries, it can have a severe effect and increase morbidity and death. Five percent of trauma patients have spinal injuries, with cervical spinal injuries accounting for more than half of these cases. The cervical spine protects the spinal cord and is made up of seven vertebrae (1, 2, 3).

Cervical spine injuries can cause severe, permanent disability. The most frequent cause of cervical injuries is trauma, which can result from car crashes, falls, sharp or penetrating wounds, sports-related injuries, or diving accidents(4-7). Compression fractures resulting from osteoporosis, arthritis, malignancy, or inflammation of the spinal cord are examples of non-traumatic causes.(8) Men are more likely than women to sustain a cervical injury. The regions C2, C5, C6, and C7 are the most often injured. The focus of this study is the analysis of the functional result and cervical spine injury recovery treated with locking titanium anterior cervical plate stabilization and anterior cervical fusion and decompression for sub-axial cervical spinal injuries.

MATERIALS AND METHODS:

This retrospective study, which was carried out between January 2021 and January 2022, comprised 20 patients with neurological deficits resulting from cervical spine injuries who were hospitalized at the orthopaedic department of Saveetha Medical College Hospital in Chennai. Fracture dislocation and subaxial cervical fracture were the only two conditions for inclusion. Multiple spine injuries and SCIWORA were the exclusion criteria.

Out of the twenty-one individuals in the present study, one patient was not found for follow-up. Six of the twenty cases involved complete spinal cord injuries, whereas the other fourteen cases involved incomplete injuries. ASIA grading was used to evaluate each case's clinical status before surgery[Fig. 1]. X-ray, lateral, swimmers' lateral views, open mouth, oblique, MRI, and CT scans were also performed, and the results were recorded.

The patient along with their family were fully apprised of the reason for the surgery and the neurological recovery process before giving their appropriate informed written consent. Every patient received treatment in the ICU while having their vital signs, including blood pressure, oxygen saturation, respiration, and pulse rate, closely monitored. Intravenous fluid may be given as crystalloid or colloid, blood, or plasma if the average arterial blood pressure is less than 90mm Hg. For patients who came to see us within 8 hours of the injury, 5.4 mg/kg over 24 hours and a 30 mg/kg IV bolus of methyl prednisolone were administered. Patients were assessed neurologically during resuscitation using the ASIA impairment scale[Fig. 2]. On the basis of sensory function or motor retention, patients were categorized as having a complete or incomplete lesion. After the patient had stabilized, an X-ray of the

cervical spine, as well as anteroposterior and lateral views with shoulder traction was used for radiological examination. To view the skeletal features, such as retro pulsed pieces in unstable burst fractures, a CT scan was performed. An early MRI scan was carried out to assess the health of the spinal cord, ligament damage, and disc.

If there is no sign of posttraumatic disc prolapse on MRI, the rapid traction method is utilized to try and minimize unifacetal or bifacetal dislocation by adding weights to the skull traction while continuously evaluating the neurological state. A strong cervical collar was used to immobilize each patient with posttraumatic disc prolapse, and an early surgical decompression treatment was carried out. Anterior cervical decompression, stabilization, and fusion with a locking titanium anterior cervical plate were the procedures that were performed.

Using an anterior technique, the patient is sedated, lying supine with their neck slightly extended, and a sandbag is placed beneath their shoulder blades. Skull tongs are used to maintain the cervical spine's axial traction during the process. The Robinson & Southwick method employs either a vertical or transverse incision. The incision is placed two to three finger breadths above the clavicle for C6 & C7, and three to five finger breaths above the clavicle for C3–C5. The platysma and skin are cut. The deep cervical fascia's outermost layer was cut. It was determined that the anterior border of the sternomastoid muscle was retracted laterally. Next, an incision was made in the deep cervical fascia's middle layer. Laterally, the sternomastoid and carotid sheath were retracted. The trachea, thyroid gland, and oesophagus were located and pushed back medially. The pre-tracheal and prevertebral deep layers of the cervical fascia, which cover the longus colli muscle, were separated. Clinical and fluoroscopic methods were used to determine the extent of damage. Subperiosteally, the “longus colli muscle then retracted back to the uncovertebral joints level. Curettes are used to cut the anterior longitudinal ligament, release the annulus, and remove the disc material. Until the posterior longitudinal ligament is visible, the disc material is removed. Power burrs were used to do a corpectomy if necessary, up until the posterior region of the vertebral body was reached. Pituitary rongeurs were utilized in the removal of the posterior cortical wall, the disc pieces, and retro-pulsed bone.

Reduction is carried out by manual traction, vertebral body spreaders, or Casper pins following discectomy or corpectomy. Next, the end plates—the superior and inferior were ready. After placing a tri-cortical iliac graft in the opening, traction was removed. The bone graft and disc space distraction were examined with an image intensifier. 4 locking screws and 2 head locking screws with imaging control were used” in anterior cervical locking plating, in the case that appropriate reduction and distraction were attained. After complete haemostasis, the wound was layer-closed. Philadelphia cervical collars were used to immobilize all patients.

On the second day, according to their neurological condition, patients were made to sit in bed with or without assistance. Following the tenth day of suture removal, patients were discharged from the hospital based on their improved neurological condition. In the sixth and twelfth weeks, flexion and extension X-rays are used to evaluate the fusion. If solid fusion was observed, the collar was taken off, and gradual neck motions were initiated. After that, the patient is monitored monthly for the first six months, then every two months for the following 6 months, and finally every six months after that.

From the preoperative phase, chest physical therapy was provided. Walking training and bed-to-wheelchair transition were both permitted if muscle strength was permitted. IBM “SPSS Version 22 was utilized for data analysis. Categorical variables were exhibited as percentages and numbers, whereas

continuous variables were represented as mean and SD. The chi-square test was utilized to compare categorical variables. A P-value <0.05 was employed to assess statistical significance.

RESULTS:

The most common age group in this study was 25 to 35 years with 10 (50 %) patients. The minimum age in the study was 19 years. Our study's maximum age was 68 years old. In our study, the mean age was 32.2 years, with a range" of 19 to 68 years. Eight Females (40%) and twelve males (60%) were present [Fig. 3]. Traffic accidents account for the majority of injuries (55%), with accidental falls coming in second (25%)[Fig. 4]. Thirteen patients (65%) in the study group have partial spinal cord injuries, such as ASIA grades B & C. [Fig. 5]. Only 5(25 %) patients had complete cord injury. There was no recovery in one patient with a complete lesion (ASIA – A). Forty percent of grade patients with partial lesions recovered to a D level, while forty percent recovered to a C level. Out of the 7 patients having ASIA grade C, 6 patients (30%) improved to grade D, while 1 patient (5%) enhanced to grade E.

After C-4/C-5 (20%) and C-6/C-7 (30%), "the least common level of injury was C-5/C-6 (15%). In our investigation, C-3/C-4 (35%) was the most frequently occurring site [Fig. 6]. There was an increase of 1.23+_0.62 in the patients' neurological status between their pre-operative and post-operative states. This increase in the postoperative status was confirmed to be statistically significant by utilizing the Paired T sample test" (P<0.0005 +_- 3.45) as well as the 95 % confidence interval–1.40 to - 0.52).Six (42.6%) of the 14 dislocation cases that we had were reduced by closed manipulation without anesthesia in less than twenty-four hours, while eight (57.3%) dislocation cases were not reduced. There was no further neurological decline observed in closed manipulation patients.

In this investigation, 11 (73.3%) anterior cervical discectomies and fusion with a tri-cortical iliac graft were performed, stabilizing the anterior cervical plate to prevent dislocations. To stabilize the anterior cervical plate in the event of a fracture, we performed 4 (26.7%) anterior corpectomy and fusions utilizing a tri-cortical iliac graft. With an average height of 9.35mm and a range between 8-18mm, we employed the tri-cortical iliac graft in all of the cervical fusion instances. The graft height is minimal in discectomies and substantial in corpectomies.

In our series, the majority of patients achieved fusion at six weeks. When the patient was 24 weeks old, fusion was achieved [Table 1]. No patients were lost to follow-up in our study. 4 cases developed bed sore, five cases developed urinary tract infection, and one case developed paralytic ileus and superficial infection in one case[Figure 5].

DISCUSSION:

When a cervical spinal injury is linked to a neurological deficiency, it can be a grave problem that increases morbidity and death significantly. There are disagreements over the precise treatment plan and when to intervene. The goal of all elements of care is to avoid secondary spinal cord injuries, of which mechanical compression is among the most significant reversible factors.

Patients who underwent an earlier surgery had a sooner recovery. The mortality rate is much higher in cases of late surgery; it is likely that these patients would be in a recumbent position for longer, which could be harmful to their cardiorespiratory health. The necessity of anterior cervical surgical stabilization to stop additional damage from occurring when the spinal cord is wounded was first discussed by Badgley and Bailey (9), Southwick and Robinson (10), et al. According to Bohlman and Henry (11,12) et al., anterior decompression and fusion result in the best recovery of neuronal function and stability restoration. He claimed that the usage of steroids was linked to gastrointestinal bleeding and that they had no effect on neurological rehabilitation.

Anterior decompression and fusion procedures were carried out in our series between one day and 36 days following the injury, with a mean of 11.2 days. In fifteen cases, every incomplete lesion has

fully healed. The outcomes of Bohlman (11) et al, Cloward et al (13), and Cone, William, Turner, et al (14) are contrasted with these findings. According to Raynor et al. (15) anterior fusion and ambulation are effective treatments for severe cervical spinal injury. Methylprednisolone infusion was administered to just two patients in our research who arrived within eight hours after the accident. There are no gastrointestinal haemorrhages in any of them.

With reference to reduction, according to Robert et al. (16), the reduction should only be tried under anaesthesia once dislocation is complete, and administering anaesthesia is not a risky technique. However, no anaesthesia was used during any of the reductions in our study. Thirty-six successful reductions without a single mortality were reported by Brookers et al. Skull traction by means of skull calipers is the treatment of choice, according to Barnes (1948) et al. Open reduction was required in 4% of Durbin's study of 53 dislocations and fracture dislocations. No evident neurological gain was observed in patients who had surgery within 72 hours of the damage, according to Vaccaro and colleagues (17). The significance of a herniated intervertebral disc in individuals with dislocation or subluxation has been suggested by Eismont et al (15).

We had five occurrences of urinary tract infections, which were treated with betadine bladder wash and the necessary parental antibiotics, and four cases of bed sores, which were treated with flap covers [Fig. 7]. We treated a superficial infection in one case with consistent dressing changes and medicines. A patient experienced paralytic ileus, which was treated with intravenous fluids and aspiration of Ryle's tube. The patient's age and neurological condition at the time of the incident were the two most significant factors influencing the prognosis of neurological recovery. This is further supported by our study, which found that improved neurological recovery was experienced by 80% of individuals under 40 with partial lesions. Patients with cord contusion findings on their MRIs recovered poorly.

CONCLUSION:

In cases of partial cord damage, surgical decompression and fusion paired with stability facilitates neurological recovery. A safe and efficient treatment for acute sub-axial cervical spinal injury is anterior cervical decompression and fusion with a tri-cortical iliac graft. This procedure has a good chance of minimizing pain, encouraging neurological recovery, and improving functionality. By employing locking anterior cervical plating, grafting problems such as graft failure and kyphotic deformity decreased, and the fusion rate increased. Young age with partial lesion healed rather well.

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Ethical approval: Not required

Fig. 1 ASIA grading

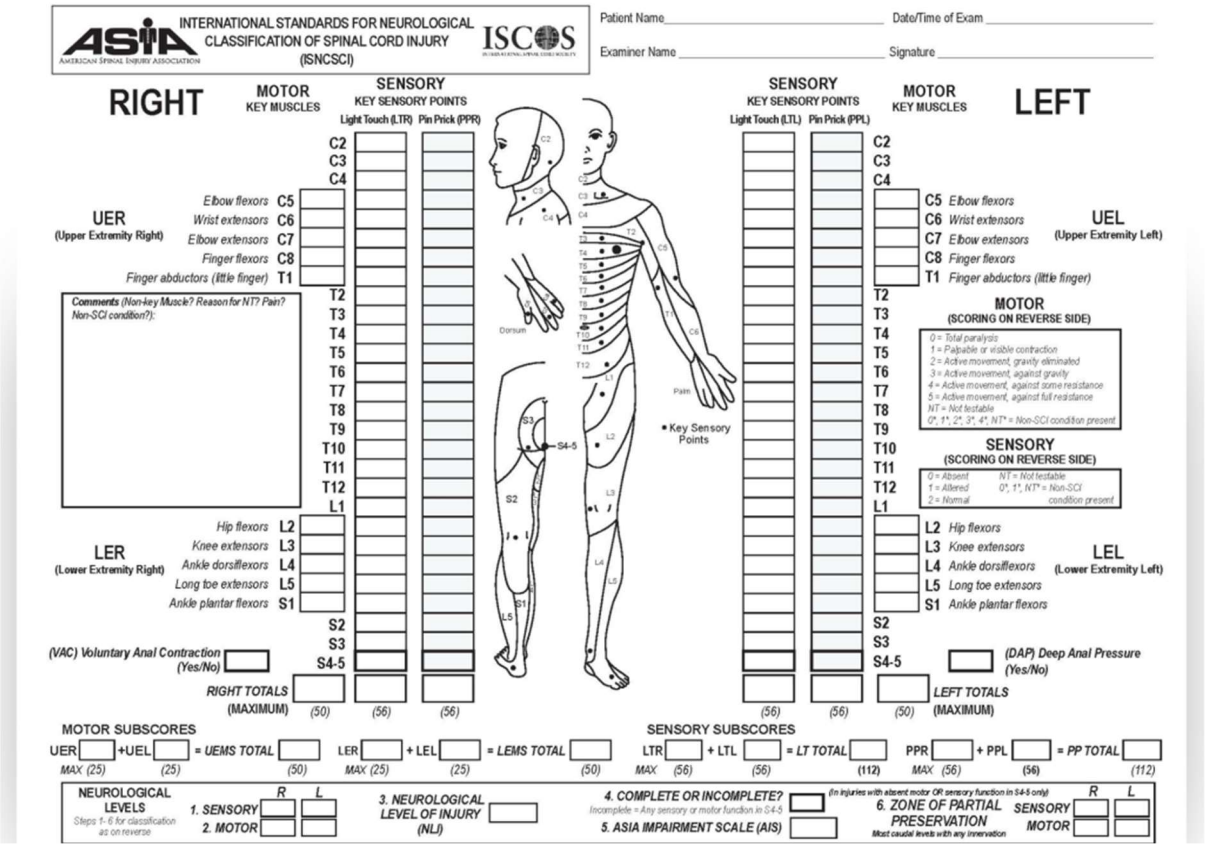

Fig. 2 showing ASIA impairment scale

ASIA Impairment Scale		
A	Complete	No motor, no sensory, no sacral sparing
B	Incomplete	No motor, sensory only
C	Incomplete	50% of muscles LESS than grade 3 (can't raise arms or legs off bed)
D	Incomplete	50% of muscles MORE than grade 3 (can raise arms or legs off bed)
E	Normal	Motor and sensory function are normal

Fig. 3 showing gender distribution of patients

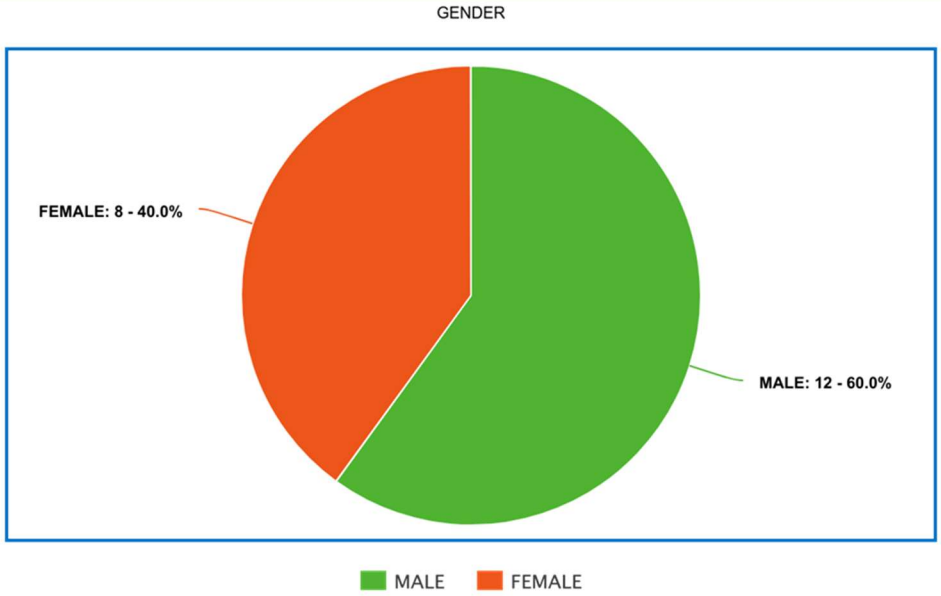

Fig. 4 showing distribution of mode of injury of patients

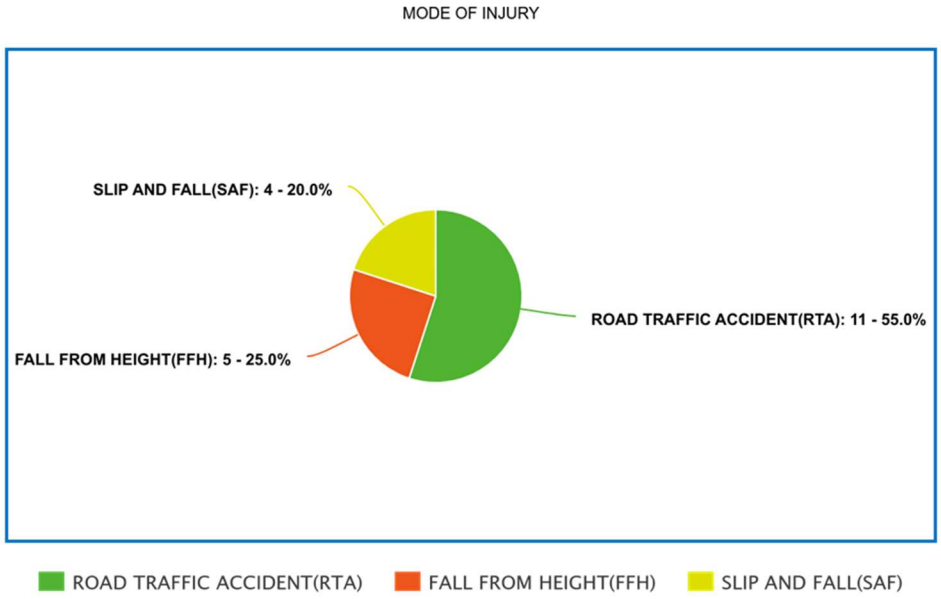

Fig. 5 showing distribution of patients with different ASIA grade

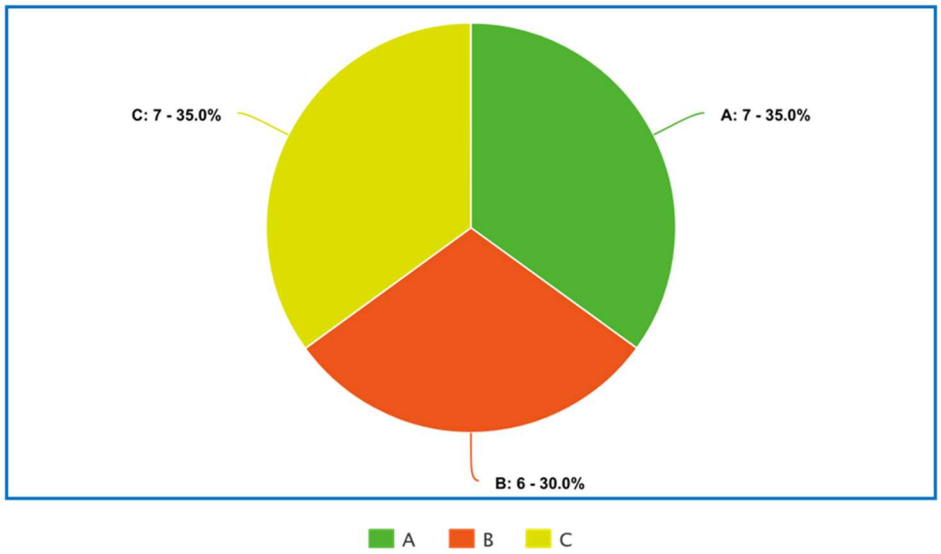

Fig. 6 showing patients with different vertebral levels of injury

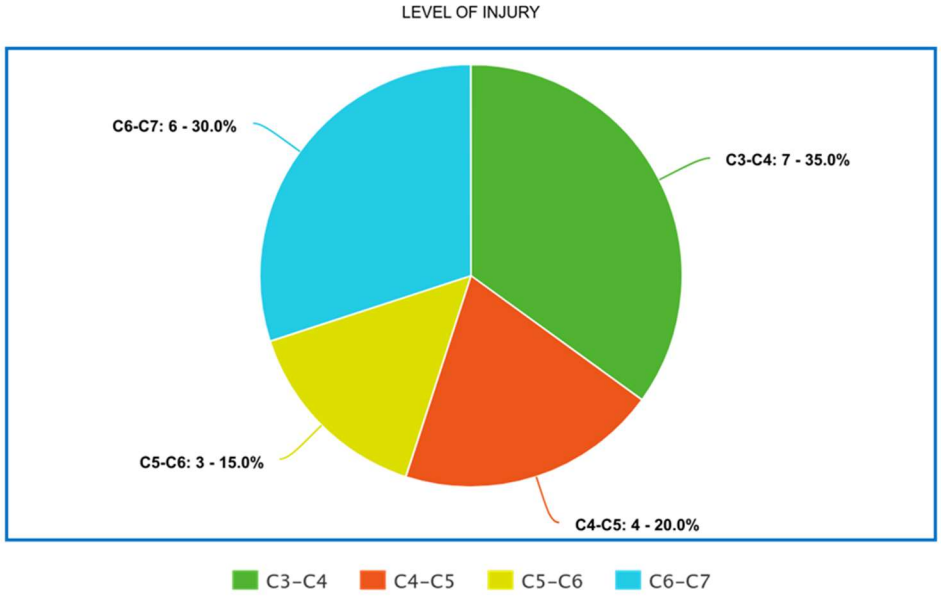

Fig. 7 showing different complications

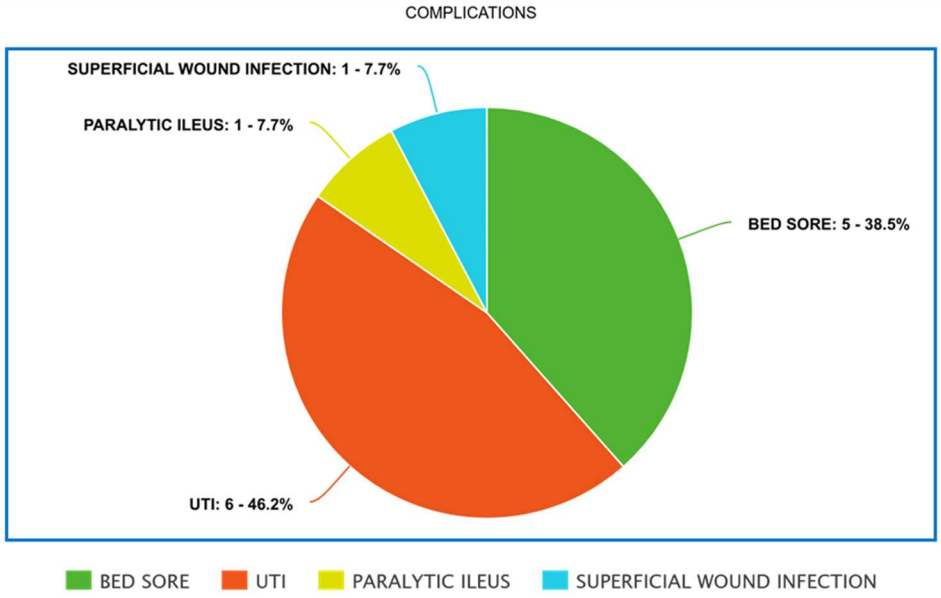

Table 1 showing master chart of all patients

S.NO	AGE	SEX	MODE OF INJURY	LEVEL OF INJURY	TIME FROM INJURY TO DECOMPRESSION(DAYS)	OPERATIVE PROCEDURE	REDUCTION METHOD	ASIA GRADE		SIZE OF GRAFT	COMPLICATIONS	TIME TO FUSION (WEEKS)
								PREOP	POSTOP			
1	24	F	RTA	C6-C7	3	C6-C7 DISCECTOMY AND FUSION	CLOSED MANIPULATION	A	A	8	BED SORE	6
2	21	M	FFH	RETROLISTHESIS C5-C6	2	DISCECTOMY AND C5-C5 FUSION	SKULL TRACTION	B	C	8	UTI	12

3	40	M	RTA	C3-C4	3	C3-C4 DISCECTOMY AND FUSION	CLOSED MANIPULATION	B	C	16	PARALYTIC ILEUS	20
4	24	F	RTA	C4-C5	5	C4-C5 DISCECTOMY AND FUSION	SKULL TRACTION	A	B	8	UTI	12
5	25	M	FFH	C5-C6	2	C5-C6 DISCECTOMY AND FUSION	CLOSED MANIPULATION	C	D	16	BED SORE	6
6	34	F	RTA	C6-C7	6	C6-C7 DISCECTOMY AND FUSION	SKULL TRACTION	A	C	18	SUPERFICIAL WOUND INFECTION	12
7	29	F	RTA	C5-C6	2	DISCECTOMY AND C5-C5 FUSION	CLOSED MANIPULATION	C	D	8	BED SORE	6
8	40	M	RTA	C6-C7	3	C6-C7 DISCECTOMY AND FUSION	CLOSED MANIPULATION	A	C	7		16
9	26	F	RTA	C3-C4	4	C3-C4 DISCECTOMY AND FUSION	SKULL TRACTION	A	C	7		6

10	48	M	SAF	C3-C4	2	C3-C4 DISCECTOMY AND FUSION	SKULL TRACTION	B	C	6		12
11	68	M	RTA	C6-C7	3	C6-C7 DISCECTOMY AND FUSION	SKULL TRACTION	B	D	16		6
12	30	M	RTA	C3-C4	4	C3-C4 DISCECTOMY AND FUSION	CLOSED MANIPULATION	C	D	6	BED SORE	12
13	42	F	SAF	C6-C7	3	C6-C7 DISCECTOMY AND FUSION	SKULL TRACTION	A	C	8	UTI	6
14	21	F	FFH	C4-C5	3	C4-C5 DISCECTOMY AND FUSION	SKULL TRACTION	B	D	6		12
15	32	M	RTA	C3-C4	2	C3-C4 DISCECTOMY AND FUSION	CLOSED MANIPULATION	B	D	6		6
16	19	M	RTA	C4-C5	4	C4-C5 DISCECTOMY AND FUSION	SKULL TRACTION	C	E	7	BED SORE	20

17	34	M	SA F	C3-C4	6	C3-C4 DISCE CTOM Y AND FUSIO N	SKULL TRACTI ON	A	C	8	UTI	12
18	31	F	FF H	C4-C5	7	C4-C5 DISCE CTOM Y AND FUSIO N	SKULL TRACTI ON	C	D	6		24
19	28	M	FF H	C3-C4	3	C3-C4 DISCE CTOM Y AND FUSIO N	CLOSED MANIP ULATIO N	C	D	16	UTI	24
20	28	M	SA F	C6-C7	5	C6-C7 DISCE CTOM Y AND FUSIO N	SKULL TRACTI ON	C	D	6	UTI	6

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