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Comparing the Influence of Surgical and Conservative Treatments based on Quality of Life of individuals with spinal cord injury

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Objective: The purpose of this study was to evaluate the impact of surgical and conservative, non-surgical treatment on functional abilities and general Health-related Quality of Life (QoL) of individuals with Spinal Cord Injury (SCI) using Spinal Cord Independence Measure scale (SCIM) and brief version of World Health Organisation Quality of Life questionnaire (WHOQOL-BREF).

Methods: 50 patients with SCI were enrolled in this non-randomized clinical trial. Based on clinical symptoms and radiologic findings, patients were considered under surgical or conservative treatments. The SCIM-III and WHOQOL-BREF questionnaire was assessed at baseline and at 3, 6 and 12 months.

Results: 34 Patients were operated & 16 were received conservative treatments. Both study groups demonstrated treatment success, functional recovery when the baseline characteristics ($p < 0.001$). The functional abilities SCIM III and WHOQOL-BREF score was significantly better in surgical managed group as compared to those receiving conservative therapy. Scores, T1, T2 and T3 were measured, the success rate of treatment was comparable between the study groups at 3 ($p = 0.741$), 6 ($p = 0.579$) and 12 ($p = 0.858$) months intervals, surgical therapy had significantly higher success at 3 month interval ($p = 0.031$).

Conclusions: More physical recovery seen in surgical treatment as it preferred more in comparison to conservative treatment in patients with SCI.

Key-words: SCI-Spinal Cord Injury, SCIM-Spinal Cord Independence Measure scale, QOL- Quality of Life, WHOQOL-BREF -World Health Organisation Quality of Life

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INTRODUCTION

Spinal cord injury is a relatively low incidence high cost injury that results in tremendous change in an individual's life which, cause permanent or temporary changes in its functions such as loss of locomotor function, bladder, bowel, sexual and autonomic function with several disabilities.

According to the National Spinal Cord Injury Statistics Centre, there are 12,500 new cases of SCI each year. More than 90% of SCI cases are caused by incidences such as road traffic accidents, violence sports or falls. The Male-to-female ratio of 2:1 for SCI, more frequently in adults compared to children. SCI was managed by operative and conservative, non-operative treatment. [1]

The surgical and non-surgical groups showed no significant differences in the following seven clinical features: age, sex, distance travelled to the unit, time interval between trauma and admission, type of accident, severity of injuries to the spinal cord and severity of associated injuries.[2]

Conservative methods for SCI are mainly immobilization of affected parts to prevent further damage by use of orthosis like neck braces-cervical collar, rigid braces, lumbosacral and sacroiliac belts, corset braces, plaster jacket, molded jacket and hyperextension braces according to injury. Most people enter in intensive care after a SCI. If any breathing difficulties, ventilator can be used for necessary oxygen.

Surgical intervention determined by the degree of deficit, location of injury, instability, cord impingement and compression. The operative procedures are performed with the aim of neural decompression, fusion for restoration and reduction of bony structures for spinal column alignment by pedicle screw fixation, posterior lateral fusion, hard shell fixation and laminectomy. [3, 4] Surgical intervention to prevent further neurological damage through decompression reduces complications related to immobility and facilitates earlier rehabilitation which remains critical in optimising outcomes. Patho-physiology of SCI needs to understand to develop novel treatments with the aim of restoring neurological function to pre injury level. [5]

Operative management of SCI was more efficacious, more compliant but had similar co-morbidity with respect to conservative management. But on the basis of treatment cost and complications conservative management is mostly preferred in rural areas.[6] Operative treatment was associated with a lower overall mortality rate (6.1%) than non-operative

(15.2%), despite a higher frequency of thrombo-embolic complications in the surgical group. [7, 8]

The level of SCI and the injury severity were measured using the American Spinal Injury Association (ASIA) impairment scale. [9]

There is risk of complication and fall in individual with SCI due to unsuitable environmental condition after discharge. [10] Many studies are there on motor recovery and bowel-bladder function improvement in both surgical and non surgical, quality of life in physical social, psychological and environmental in all aspect seems to be lower as compare to the general population. [11]

Brigitte Wirth et al concluded that responsiveness of SCIM II in functional changes in motor functional SCI. the SCIM I and SCIM II, both were valid and reliable previously but did not take into account intercultural differences, so SCIM III was developed in 2002 as international version to evaluate the functional impairment in SCI. It is widely used clinically for monitoring functional improvement during rehabilitation and after discharge. [12]

Health related QOL was measured by the WHOQOL-BREF; life expectancy improves after the 1st year survival, most common causes of death are pneumonia and sepsis. QOL measured by WHOQOL-BREF with timeline acute to chronic complete SCI at 3, 6 & 12 months, cognitive impairment affects adversely. [13, 14]

Craig et al. concluded that 55% of people with SCI had difficulties in social participation after discharge. [15] Lower cost and less complication in non operative methods, while operative has early mobilization and fast recovery. [16] This study evaluated the incidences of complications, changes of physical abilities by using the SCIM III and QOL by WHOQOL-BREF.

MATERIALS AND METHODS

The present study was conducted at various Spine-Care Hospital in Ahmedabad, where patients from central-west region of India from Gujarat, Rajasthan, MP from February 2022 to July 2023. Total 76 patients were taken, in which 26 drop out and 50 individual completed the study. Total 34 Patients were operated and 16 were received conservative treatment. Both groups have equal opportunity to utilize rehabilitation.

The SCIM III and WHOQOL-BREF was assessed at timeline of 3m (T1), 6m (T2) and 12m (T3) after treatment.

Inclusion criteria Cases had of age between 10 to 60 years of both the gender were included in this study. Cases with spinal column and SCIs were included in this study after diagnosis. The diagnosis of fracture, spinal column injury was made based on clinical symptoms, neurological examinations, and imaging studies, including plain radiography, X-ray, CT (computed tomography) and MRI(magnetic resonance imaging).[17]

Exclusion criteria Cases had of age ≤ 10 and ≥ 60 years and associated other fractures of the thoraco-lumbar spine and head injury, patients with osteoporotic fractures or with histories of previous spine surgery, systemic & psychological disorder or chronic pain were excluded.

SCIM III: The SCIM has been developed to address three specific areas of function total of 100, self-care (20) (feeding, grooming, bathing, and dressing), respiration and sphincter management (40) and a patient's mobility abilities (bed and transfers and indoors/outdoors) (40). [18] It helps the clinicians in determining treatment objectives for patients with a SCI.

WHOQOL-BREF: 26 questionnaires consisting of 4 domains- physical health (7), psychological health (6), social relationships (3) & environmental health (8) was used. For that enough time was given to the patients. Each individual item of the WHOQOL-BREF is scored from 1 to 5 ordinal scales. Domain scores are not averages; they are the sum total score for each question, the scores are then transformed linearly to a 0–100 within domains. [19, 20]

Data Collection

The study was approved by the Sangini Hospital Ethics Committee at Ahmedabad. The study protocol was registered and consents were obtained from all patients prior to their inclusion in this study. The patients were recruited by consecutive sampling method. The procedures followed were in accordance with the ethical standards. In those undergoing surgery, were performed under total anesthesia by pre-established surgeons following the surgical protocol, SCIM III score and WHOQOL-BREF score was taken at admission and at the interval of T1=3, T2=6 and T3=12 months after treatment. Same in conservative treated, assess and physical abilities and QOL of the patients were measured by using the SCIM-III and the WHOQOL-BREF consecutively. The choice of treatment method was determined according to patient's clinical status such as age, the degree of injury or damage type, simultaneous injury, neurologic deficit, degree of residual canal, height loss, vertebral angulations and patient's satisfaction. Both study groups demonstrated treatment success, functional recovery from acute to chronic all time points T1, T2 and T3.

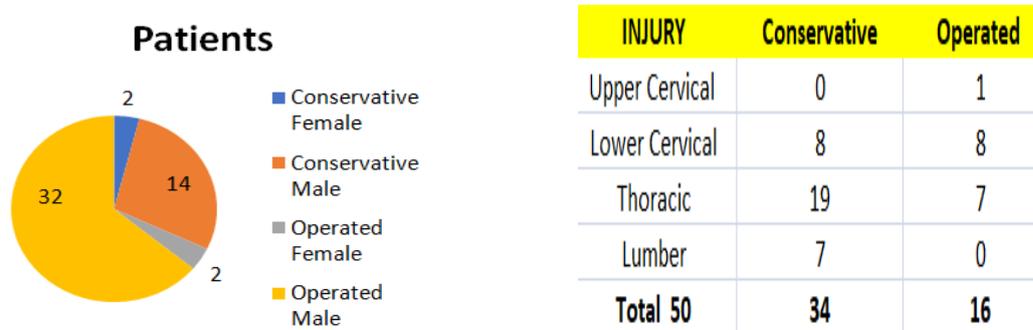
STATISTICAL ANALYSIS

Descriptive statistics were used to characterize patient demographics and clinical details. In excel differences between T1 to T3 and within group and between both groups SCIM III & WHOQOL-BREF were calculated and investigate differences with paired t-tests using all responses. One way-ANOVA model was used to compare quality of life between both the groups.

RESULT

34 Patients were operated in which upper cervical (C1-C2) 0, lower cervical (C3-C7) 8, thoracic 19 and lumber 7 among which male: female ratio was 32:2, 16 were received conservative treatment in which upper cervical (C1-C2) 1, lower cervical (C3-C7) 8, thoracic 7 and lumber 0 among which male: female ratio was 14:2 in people with SCI.

Figure 1: Characteristics of 50 patients with male: female and Level of Injury



Both study groups demonstrated treatment success, functional recovery at the baseline characteristics ($p < 0.001$). Average age of the patients was 34.86 years. Majority of case were dorsal spine as wedge compression of vertebra is very commonest flexion injury in fall. (**Figure:1**) After 6 months, physical abilities and QOL of the patients was improved.

In conservative group SCIM III score 30.93, 40.37 and 48.50 and QOL score 47.20, 52.96 and 57.88 at 3, 6 and 12 months respectively shows improvement with significant difference.

Table 1: Characteristics of 50 patients with means of SCIM III and WHOQOL-BREF

Treatment	Patients 50	SCIM-1	QOL1	SCIM-2	QOL-2	SCIM-3	QOL-3
Conservative total	16	30.93	47.20	40.37	52.96	48.50	57.88
Operated total	34	36.20	46.25	44.50	52.22	53.11	57.51

In operated group SCIM III score 36.20, 44.50 and 53.11 and QOL score 47.20, 52.96 and 57.88 at 3, 6 and 12 months respectively shows improvement with significant difference. Here, the difference between the two group at T3=12 months in SCIM III score is 4.61 and WHOQOL-BREF score is 0.37, which shows in both the groups shows near to equal up gradation in QOL. (**Table: 1**)

Table 2: Descriptive statistic of mean score of SCIM III and WHOQOL-BREF

Different Phases	Conservative Treatment		Operated Treatment		p Value for Group Difference, two-tailed
	Mean	SD	Mean	SD	
T1 (3MONTHS)	39.07	10.68	41.23	9.05	0.461
T2 (6MONTHS)	46.67	10.97	48.36	8.96	0.565
T3 (12MONTHS)	52.88	10.44	55.31	8.80	0.394

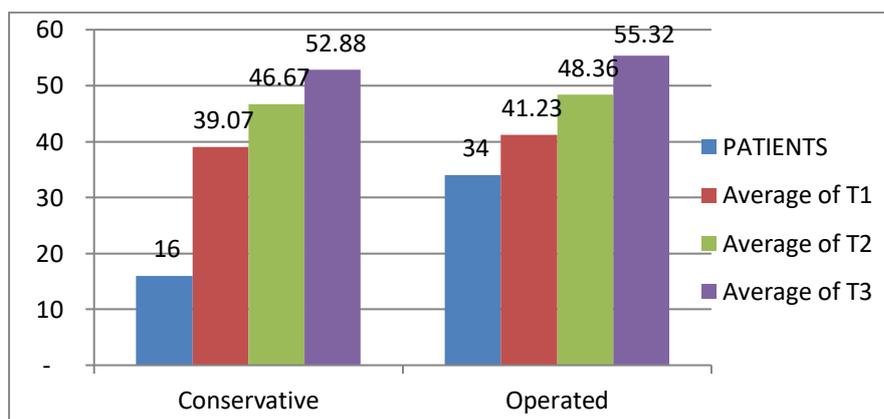
Abbreviation: SD, standard deviation

Both the score shows all over improvement in functional abilities and QOL of patients with a SCI. Combine mean score of the both scale also compared with timeline 3, 6 and 12 months interval and founded by applying t test between groups which is not statistically significant as p is greater than 0.05 at time 3 ($p=0.461$), 6 ($p=0.565$) and 12 ($p=0.394$) months intervals, surgical therapy had significantly higher success are in 3 months interval ($p=0.031$) in the group.

In the conservative treatment group, combine mean scores difference T2–T1 (7.60, $p < 0.013$), T3–T2 (6.21, $p < 0.001$) and T3-T1 (13.81, $p < 0.001$), were differed statistically significant as p is less than 0.001.

In the surgical treatment group, combine mean scores of T1, T2 and T3 differed significantly from acute to chronic phase (T1 to T3) measures T2–T1 (7.13, $p = 0.0017$), T3–T2 (6.95, $p < 0.0019$), T3–T1 (14.08, $p < 0.0001$)). (**Table: 2**)

Figure 2: Comparison of mean of both scores between two groups conservative and operated with different time phase T1, T2 & T3



Comparison of mean of both scores between two groups (conservative and operated) with different time phase T1, T2 & T3 shows significant difference. Higher score was seen SCIM III in operated group due to neurological recovery and independence. (**Figure: 2**)

Level of injury affects all domain and functional recovery. Female are present with good social and environmental domains in QOL as compared to male. Mobility and physical

function significantly associated with all QOL domains. Here T1, T2 and T3 are mean score of both SCIM III and WHOQOL BREF.

DISCUSSION

In this study more physical recovery seen in surgical treatment as it is preferred more in comparison to conservative treatment. Influence of modifying factor for rehabilitation and therapeutic approaches. [21] Marcel studied on post surgery motor recovery and length of stay (LOS) with ASIA grades A, B, C, or D and were treated surgically and analyzed to determine the effect of timing of surgery 24, 48 or 72 hours from injury showed that an incomplete acute traumatic SCI in cervical, thoracic or thoraco-lumbar spine, if surgery was performed within 24 hrs from injury improves motor recovery. [22]

A developing country like India lacks epidemiological data on acute SCI. Guttman, Frankel et al demonstrated with expert conservative management, patients made some neurological recovery in complete injury and most with incomplete cord injury recovered ambulation regardless of X-ray findings. Post discharge supervision helped person with SCIs to enjoy complication free, dignified, productive and even competitive lives in sports and employment. [23] Fall from height, road traffic accidents and violence or any spots injuries were common cause of SCI founded in this study. After discharge around 6-8 months there were stability in life in post trauma chronic SCI phase showed minimal changes of QOL and physical abilities. Risk of complication also reduced with life style modification in chronic cases.

C.H. Tator, E.G. Duncan et al concluded that there was no difference between operated and non-operated patients in length of stay or neurological recovery. Surgical management of patients with acute SCI appears safe in terms of mortality rate and neurological recovery, after studied 208 patients treated in an ASCU, 116 (56%) of whom underwent at least one spinal operation, regime on the complication rates indicates that surgery significantly increased the incidence of thrombo-embolic but not the other complications. Four deaths prior to discharge in the operated group were due to pulmonary embolism, one 16 days after surgery while the other occurred after eleven months, following a long hospitalization and multiple complications in 2015. The increased mortality rates in the conservative or non-operated patients mostly those with cervical injuries. [24]

Mark Maranon et al studied in 2021 on functional outcome and QOL of Potts disease with incomplete SCI, who have undergone surgical versus non-surgical management and founded that significant improvement was noted from both groups after 1 year of treatment, better final score in SF 36 and ODI (Oswestry Disability Index) in operated cases. [25]

K.Nowakowska-Domagala et al in 2017 studied on long term rehabilitation and psychological adaptation and suggested that the psychological aspects of QOL observed after SCI maybe associated with an emotional coping style. Further study regarding causes and strategies of prevention and health promotion is important for minimizing the consequences of SCI. [26]

We identified no significant differences between the early and late surgery groups in the post-surgery interval until the final neurological examination in complete, suggesting that the groups had an equal opportunity to benefit from rehabilitation/natural recovery. As persons with incomplete SCI were shown to have a larger anticipated amount of motor score recovery, preferentially selecting incomplete participants for early surgical intervention is a bias.

Persons with incomplete ASIA B, C, and D injuries from C2 to L2 demonstrated motor recovery improvement of an additional when they underwent surgical treatment within 24 hrs from the time of injury, compared with those who had surgery later than 24 hrs post-injury. This beneficial effect of early surgery on motor recovery was not seen in the patients with ASIA A complete SCI. ASIA A and B patients who received early surgery experienced shorter hospital stay although the issues of when to perform surgery and what specific operation to perform remain controversial. This work provides evidence that for an incomplete acute TSCI in the cervical, thoracic, or thoraco-lumbar spine, surgery performed within 24 hrs from injury improves motor neurological recovery. Early surgery also reduces length of hospital stay.

Many studies demonstrated that operative treatment had no statistically significant radiographic or functional outcome benefits with respect to non-operative treatment. Also documented that the patients who were managed operatively had experienced higher care cost and higher complication rate, where as hospital stay was prolonged in non-operative treatment.

But in present study, significant change was found in case of operative treatment with respect to conservative treatment in SCIM III outcome. The WHOQOL-BREF outcome was near similar in both treatment groups.

CONCLUSION

In this study operative manage group was more efficacious, more compliant but had similar co-morbidity with respect to conservative management.

In India, early medical management and rehabilitation of SCI patients are improved day by day. Problems are still there like inadequate rescue, retrieval system and specialized centers for management in rural areas for SCI.

In acute phase early mobilization shows much physical recovery in operated group as compare to conservatively treat at 3 months and long term, but QOL is nearly equal as perception of disability is positively accepted by person as Psychological, social and environmental factors are sturdy enough with the time. Physical recovery is depending on early mobility and personal care. Here, both the group shows nearly equal progress in functional and QOL with timeline at chronic phase at 12 months.

Hence, there is a need for deeper analysis of the role played by emotions and perception associated with chronic stress in patients with SCI, which affects individual independence and QOL. Healthcare workers including doctors, nurses or other paramedical staffs of rural or urban area needed to be adequately trained about early prompt handling and cautious transportation of patients with of spinal cord injuries.

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