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| RESEARCH ARTICLE

Correlation between Vitamin D and Low Back Pain in a Person of Eastern Terai of Nepal

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| ABSTRACT

Skin exposure to sunlight is the main pathway by which vitamin D is synthesized. Differently pigmented populations are at different risk of hypovitaminosis D. A hospital-based cross-sectional study was conducted from March/2025 to July/2025 at the department of orthopedics and spine surgery, Saptakoshi Neuro Hospital Pvt.Ltd (SNH), Inaruwa, Sunsari. Patients with low back pain between the ages of 18 and 80 years who met the inclusion criteria were enrolled in this study. 200 patients (53 males and 147 females) ranging from 18 to 75 years old (average 46 years) with low back pain had undergone screening. The patients with low back pain were divided into three groups (i.e, acute, sub-acute, chronic) on the basis of onset of pain. 58 patients had an acute onset, 54 patients had a sub-acute onset, and 88 patients had a chronic onset. Blood investigations like Serum vitamin D level, Serum Calcium level, and inflammatory markers like CRP and ESR were measured. Visual analogue scale (VAS) and Oswestry disability index, nepali version (NV-ODI)[7] were used for evaluation of low back pain and functional disability during the visit to the hospital. Mean serum concentrations of vitamin D in acute, sub-acute, and chronic low back pain groups were 27.96 ± 10.78, 27.34 ± 8.54, and 23.29 ± 6.67 ng/ml, respectively (P ≈ 0.002). Mean serum concentration of calcium in acute, sub-acute, and chronic low back pain groups was 8.89 ± 1.23, 8.74 ± 0.95, and 8.49 ± 0.91 mg/dl, respectively (P ≈ 0.067). Serum concentration of inflammatory marker C-reactive protein (CRP) in acute low back pain were ≤ 6 mg/L (100%), sub-acute low back pain were ≤ 6 mg/L (98.1%) and > 6 mg/L(1.9%), and chronic low back pain groups were ≤ 6 mg/L (90.9%) and >6 mg/L (9.1%), respectively (P ≈ 0.019). Mean serum concentration of inflammatory marker erythrocyte sedimentation rate (ESR) in acute, sub-acute, and chronic low back pain groups was 21.93 ± 6.99, 23.54 ± 5.14, and 27.07 ± 5.42 mm/Hr, respectively (P < 0.001). The study concluded that the prevalence of LBP is high among individuals with a low level of serum vitamin D and a low concentration of serum calcium level.

| KEYWORDS

Low Back Pain, Vitamin D, Hypovitaminosis, Inflamatory markers

| ARTICLE INFORMATION

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1. Introduction

The population of the terai region of Nepal has good direct exposure to sunlight. Low-deficient vitamin D status has higher levels of inflammatory markers like CRP, and vitamin D therapy reduces the process of inflammation.[1] Low

back pain is a leading cause of disability and is a significant public health problem.[3] Gunaydin O et al.[4] demonstrated that the red cell distribution width has a poor diagnostic value for chronicity of low back pain. The risk factors for low back pain include overweight, smoking, physical inactivity, and poor diet.[5] Vitamin D plays a vital role in the metabolism of calcium and has essential role in the inflammatory/immune response. Back pain is significantly associated with serum vitamin D level and confounded by sociodemographic factors.[6] Williams A et al.[8] showed that the effectiveness of targeting lifestyle to manage back pain is uncertain in a study of association between lifestyle risks and back pain whereas the disability due to back pain increase the risk of chronic diseases. Vitamin D is a fat-soluble vitamin, hormones and hormone precursors because of its endogenous synthesis and has effect on bone mineralization, calcium and phosphorus metabolism. Deficiency of vitamin D is associated with many chronic diseases and is now considered as a global epidemic. Serum 25-hydroxyvitamin D (25(OH)D) level should be measured to assess the Vitamin D status.

- Adequate >30 ng/mL
- Vitamin D deficiency = 20–30 ng/mL
- Lack of vitamin D<20ng/mL
- Serious lack of vitamin D<10 ng/mL

Low back pain is caused by disorder of muscle, ligaments, intervertebral disc, vertebral body and the nerve function, or inflammation or infection and is located in the lower back, lumbosacral, and hip regions, with or without radiation pain in the lower extremities, which can be divided into 3 types: acute(<6 weeks), sub-acute (6-12 weeks), and chronic(>12weeks).[9] On contrary, Gokcek E et al.[10] described the deficiency of vitamin D is oftenly asymptomatic but somehow it can also cause increase in severity in low back pain. Zadro JR et al.[11] reported the common manifestation of LBP is non-specific however decrease in level of vitamin D decrease the uptake of calcium and bone mineralization leading to back pain. A meta-analysis reported that hypovitaminosis D is associated with LBP.[12] However, the association between vitamin D levels, intensity of pain and disability cause by LBP is controversial. Back pain can lead to high medical costs and other undesirable effects on personal and social development.[12] The systemic inflammation may act as a mediator for physical inactivity and obesity in the pathogenesis of chronic non-specific low back pain.[13] Mazidi M et al.[14] reported that the vitamin D supplement has no impact on serum concentration of inflamaroty markers like CRP. The serum level of vitamin D modulate the excitability of sensory neuron and has relation with low back pain.[15] The clinical findings of vitamin D deficiency depends upon the grade and duration of deficiency causing decrease in bone mineral density, musculoskeletal pain, weakness and fractures.[17] Azizieh F et al.[18] reported that there was no significant correlations between serum vitamin D level, cytokines and CRP level. Liefaard MC et al.[19] observed the association between vitamin D and CRP and concluded that the serum vitamin D level was inversely associated with CRP (i.e. higher the serum vitamin D level lower the serum CRP level). The clinical outcomes after vitamin D supplement alone or in combination with calcium were inconsistent.[21]

Wacker M et al.[23] demonstrated the vitamin D synthesis in the body occurs under the influence of sunlight. Seasonal and geographical changes are important in the synthesis of vitamin D in presence of sunlight. The angle of sunlight reaching the earth's surface is effective in the synthesis of vitamin D. Direct sunlight contact on the skin is required for the synthesis of vitamin D. (80%–90%) is synthesized in the skin by ultraviolet B rays. About 20,000 IU vitamin D synthesis occurs when the skin is exposed to sunlight and appears light pink colour at appropriate times during summer. Lips P et al.[24] reported low calcium intake causes or aggravates vitamin D deficiency while a high calcium intake is vitamin D sparing. Grossmann RE et al.[25] explained the deficiency of vitamin D may have pro inflammatory effect leading and its supplement reduces the inflammatory markers leading to improvement in low back pain. CRP is a non-specific marker of inflammation and is synthesized in response to the acute phase of a bacterial or fungal infection. CRP may be the primary defense function of the human body. Traditionally, serum CRP levels have been measured by rate nephelometry, which has a detection limit of 6 to 10 mg/L. This is the so-called "serum CRP" test. A commercially available "high-sensitivity CRP" (hs-CRP) test is a latex particle-enhanced immune turbidimetric assay that has a detection limit of about 0.15 mg/L.[28] Erythrocytes are red blood cells. The sedimentation rate is the time it takes for your red blood cells to settle at the bottom of a test tube. An erythrocyte sedimentation rate (ESR) is a blood test that can show if you have inflammation in your body.[28] Normal values using the Westergren method:

- Male: ≤15 mm/hr.
- Female: ≤ 20 mm/hr.
- Child: ≤10 mm/hr.
- Newborn: 0-2 mm/hr.

Vitamin D increases the concentration of serum calcium by intestinal absorption of calcium, bone resorption and the tubular reabsorption of calcium. The effects on intestinal reabsorption of calcium and bone resorption seem to be due primarily to the active metabolite 1, 25-DHCC. Calcium is maintained within a fairly narrow range from 8.5 to 10.5 mg/dl (4.3 to 5.3 meq/L or 2.2 to 2.7 mmol/L). Normal values and reference ranges may vary among laboratories as much as 0.5 mg/dl.[30]

2. Methods

2.1 Patient population

This is a hospital-based cross-sectional study conducted at Saptakoshi Neuro Hospita Pvt.Ltd (SNH), Inaruwa, Sunsari, Nepal. Patients with low back pain between the ages of 18 to 80 years attended outpatient and ER department of Orthopaedics and Spine Surgery from 1 April 2025 to 1 October 2025 who had given consent and fulfilled inclusion criteria were included in this study. Patients with low back pain below the age of 18 years and with specific etiology like neoplastic diseases, trauma, inflammatory systemic disease or infection (systemic lupus erythematous, rheumatoid arthritis, spondylodiscitis), severe osteoporosis, cardio-cerebrovascular, hepatorenal and digestive disease, pregnancy and patient receiving treatment with estrogen, vitamin D, NSAIDs, or corticosteroids and unable to comply fully with the protocol were excluded from this study. Patients with low back pain were assessed for the clinical and relevant investigation including x-ray along with blood investigation during the visit to hospital. A detailed clinical history regarding socio-demographic variables like age, gender, location, ethnicity, mode of injury, site of injury and neurological status in all three (acute, sub-acute,chronic) groups of low back pain was collected. The clinical evaluation with VAS/NV-ODI score and relevant blood investigation like serum vitamin D level, serum calcium level and inflammatory markers like CRP and ESR were done. VAS/NV-ODI score, serum vitamin D level, serum calcium level, CRP, ESR were documented and compared in all three (acute, sub-acute, chronic) groups of low back pain. 200 patients who met the criteria for inclusion (53 males and 147 females), ranging from 18 to 75 years old (average of 46.08 ± 14.41 years) were enrolled in this study. Patients were divided into three groups:

1. Acute: Acute low back pain is defined as back pain lasting for less than 6 weeks.
2. Sub acute: Sub-acute low back pain is defined as back pain lasting between 6 and 12 weeks.
3. Chronic: Chronic low back pain is defined as pain that persists for 12 or more weeks.

2.2 Procedures

Each patient was evalauate clinically with history, physical examination and relevant radilograpy and blood investigation. X-ray lumbo sacral spine and pelvis were done to rule out any abnormal pathology related to trauma, tumor, inflammation and infection. Blood investigations like serum vitamin D level, serum calcium level, inflamatory markers like CRP, ESR. Clinical evaluation for severity and disability cause by low back pain by using VAS and NV-ODI score were done by the same surgeons of department of orthopaedic and spine surgery of same institute and same steps were followed.

2.3 25-hydroxyvitamin D

Plasma levels of 25-hydroxyvitamin D were measured in non-fasting samples of 200 subjects at the time of visit in OPD. 25-hydroxy vitamin D (25OHD) serum levels were measured using a enzyme Immunoassay, Chemiluminescence Assay. CLIA based test system intended for the quantitative measurement of total concentration of 25-OH-Vitamin D2 and 25-OH-Vitamin D3 in human serum or plasma samples (EDTA plasma, heparin plasma, citrate plasma).This test detects levels within a range of 5-120 ng/ml, with limit of detection 3.00ng/ml, accuracy relative deviation within ±15%, precision with intra-assay repeatability: CV≤8% and inter-assay reproducibility: CV ≤15.

2.4 C-reactive Protein

Plasma levels of CRP were measured with slid latex kit method in non-fasting samples of 200. Only serum should be used for latex agglutination test. Uniform latex particles are coated with IgG anti-human CRP. The specimens containing CRP on mixing with latex reagent if agglutinates macroscopically at 2 minutes is a positive test and if not is a negative test. This system detect the analytical sensititvity of 6 mg/L with diagnostic sensitivity and specificity of 95.6% and 96.2% respectively.[29]

2.5 Erythrocyte Sedimentation Rate

ESR were measured with wintrobe tube method in non-fasting samples of 200 subjects at the time of visit in OPD. Approximately 1 mL of well-mixed EDTA venous whole blood was drawn up into the tube using the pipette bulb until the cotton plug was entirely saturated. The erythrocytes settled vertically out of the venous plasma toward the bottom of the tube. Sample results were read after 60 minutes at the plasma/red cell interface on the 0–100 mm graduated tube.[28]

2.6 Serum Calcium Level

Serum levels of calcium were measured in non-fasting samples of 200 subjects at the time of visit in OPD. Collected venous sample in test tube centrifuse with 3000 rpm for 5 min for serum. The calcium arsenazo reagent was used for calium dection is added (1000 microL) with 10microL serum for 5 min.This reagent is linear upto 18mg/dl. The automated agappe multicalibrator is used for calibration and the sensitivity of this method for lower detection limit is 0.5mg/dL.[30]

The sample size (n) is calculated according to the formula: $n = z^2 * p * (1 - p) / e^2$. To determine the sample size necessary to estimate with 95% confidence, considering the margin of error as 10%. Z value for a 95% confidence level is 1.96. Assuming a population proportion of 85% with vitamin D deficiency had a Mean VAS of 68.8% (6.88±0.96) during visit to the polyclinic from the study Gokcek et al.[4] and unlimited population size, the calculated is 200. The ethical approval was obtained from the Institutional Review Committee, B&C Medical College Teaching Hospital And Research Center, Birtamode, Jhapa, as the hospital is affiliated and run by college. The data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0 software for Windows. Numerical data for continuous variables were expressed in the form of mean ± standard deviation. The data for categorical variables were expressed either in number or percentage (n, %), The Kruskal-Wallis test and Pearson's Chi-square test were used to observe the association between the categorical variables. The test was considered statistically significant when the p-value <0.05.

3. Results

In this study, 200 patients with low back pain were included. Demographic data including age, sex, location, ethnicity, duration of pain, site of pain, and neurological status in the three groups were collected. Acute onset of LBP patients comprised 29% (58), sub-acute LBP 27% (54) and chronic LBP 44% (88) of the study participants. The mean age of the patient was 46.08 ± 14.41 years. (Table 2). Female patients comprised 73.5% (147) and male 26.5% (53). Muslim patients comprised 41.5% (83) and Hindu 58.5% (117) of the study participants. (Table 1).

Table 1. Demographic distribution (n=200)

Characteristics	Category	Number of patient	Percentage(%)
Gender	Male	53	26.5
	Female	147	73.5
Ethnicity	Hindu	117	58.5
	Muslim	83	41.5
LBP Onset	Sub-acute	54	27.0

	Acute	58	29.0
	Chronic	88	44.0
CRP	≤6	191	95.5
	>6	9	4.5

Table 2. Statistical analysis of variables (n=200)

Statistics	**Age**	**VAS**	**NV-ODI**	**Vit-D**	**Calcium**	**ESR**
Mean	46.08	55.89	44.87	25.74	8.67	24.63
SD	14.41	13.80	14.11	8.77	1.03	6.24
Minimum	18.00	10.00	12.00	11.84	6.20	8.00
Maximum	75.00	80.00	78.00	75.99	12.88	40.00

Table 3. Comparison of variables and Gender (n=200)

Variables	Gender	N	Mean	SD	SEM	P Value
Age	Male	53	49.26	16.03	2.20	0.060
	Female	147	44.93	13.66	1.13	
VAS	Male	53	52.83	15.24	2.09	0.059
	Female	147	56.99	13.12	1.08	
NV-ODI	Male	53	43.34	14.94	2.05	0.358
	Female	147	45.42	13.81	1.14	
Vitamin-D	Male	53	26.76	7.97	1.09	0.322
	Female	147	25.37	9.04	0.75	
Calcium	Male	52	8.79	1.15	0.16	0.348
	Female	146	8.63	0.99	0.08	
ESR	Male	53	22.74	7.67	1.05	**0.010**
	Female	147	25.31	5.52	0.46	

3.1 Biochemistry outcomes

Mean serum concentrations of vitamin D in acute, sub-acute, chronic low back pain groups were 27.96 ± 10.78, 27.34 ± 8.54 and 23.29 ± 6.67 ng/ml, respectively (P ≈ 0.002). Mean serum concentration of calcium in acute, sub-acute, and chronic low back pain groups were 8.89 ± 1.23, 8.74 ± 0.95 and 8.49 ± 0.91 mg/dl, respectively (P ≈ 0.067). Serum concentration of inflammatory marker like CRP in acute low back pain were ≤ 6 mg/L (100%), sub-acute low back pain were ≤ 6 mg/L (98.1%) and > 6 mg/L(1.9%), and chronic low back pain groups were ≤ 6 mg/L (90.9%) and >6 mg/L (9.1%), respectively (P ≈ 0.019). Mean serum concentration of inflammatory marker like ESR in

acute, sub-acute, and chronic low back pain were 21.93 ± 6.99, 23.54 ± 5.14 and 27.07 ± 5.42 mm/Hr, respectively (P < 0.001). (Table 4). Mean serum concentration of vitamin D, serum calcium and ESR in female group were 25.37 ± 9.04, 8.63 ± 0.99, 25.31 ± 5.52 respectively whereas in male group were 26.67 ± 7.97, 8.79 ± 1.15, 22.74 ± 7.67 respectively. (Table 3). Mean serum concentration of vitamin D, serum calcium and ESR in muslim group were 26.65 ± 10.37, 8.68 ± 0.85, 24.88 ± 6.10 respectively whereas in hindu group were 25.09 ± 7.41, 8.67 ± 1.15, 24.44 ± 6.36 respectively. (Table 7).

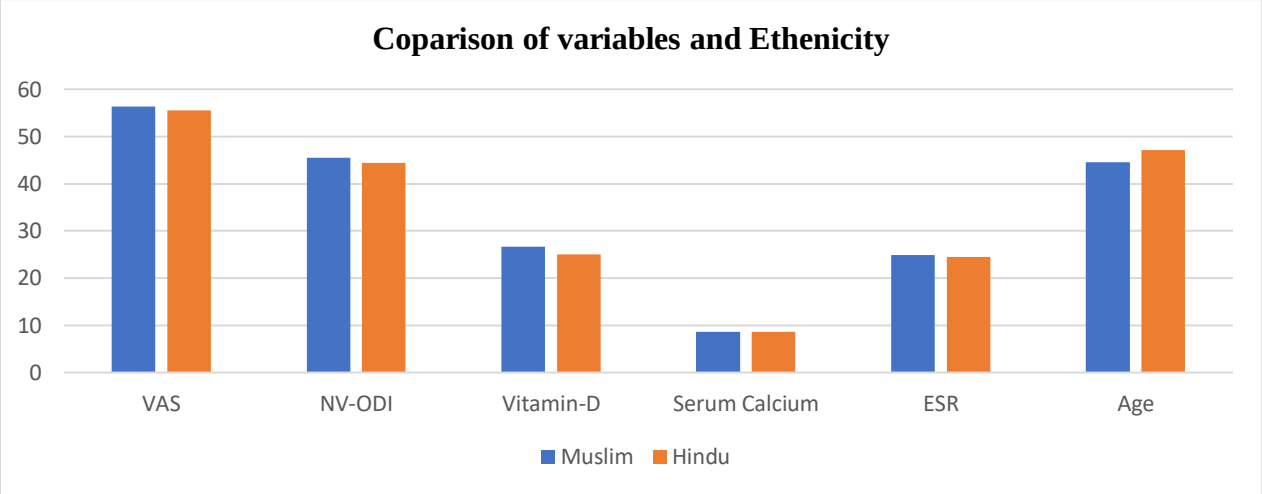

Figure 1. Comparison of variables among Muslim and Hindu groups (n=200)

Table 4. Comparison of variables among three groups of Onset of LBP (n=200)

Variables	LBP Onset	N	Mean	SD	SEM	p value
Age	Sub-acute	54	38.63	12.98	1.77	<0.001
	Acute	58	42.84	11.52	1.51	
	Chronic	88	52.77	14.09	1.50	
	Total	200	46.08	14.41	1.02	
VAS	Sub-acute	54	53.33	14.54	1.98	0.060
	Acute	58	54.38	15.45	2.03	
	Chronic	88	58.45	11.75	1.25	
	Total	200	55.89	13.80	0.98	
NV-ODI	Sub-acute	54	41.50	11.91	1.62	0.002
	Acute	58	42.07	14.28	1.87	
	Chronic	88	48.78	14.42	1.54	
	Total	200	44.87	14.11	1.00	
VitD	Sub-acute	54	27.34	8.54	1.16	0.002
	Acute	58	27.96	10.78	1.41	

	Chronic	88	23.29	6.67	0.71	
	Total	200	25.74	8.77	0.62	
Calcium	Sub-acute	53	8.74	0.95	0.13	0.067
	Acute	58	8.89	1.23	0.16	
	Chronic	87	8.49	0.91	0.10	
	Total	198	8.67	1.03	0.07	
ESR	Sub-acute	54	23.54	5.14	0.70	<0.001
	Acute	58	21.93	6.99	0.92	
	Chronic	88	27.07	5.42	0.58	
	Total	200	24.63	6.24	0.44	

3.2 Clinical outcomes

The average VAS for patients with acute, sub-acute and chronic low back pain were 54.38 ± 15.45, 53.33 ± 14.54, 58.45 ± 11.75 respectively (P ≈ 0.060). The average NV-ODI for patients with acute, sub-acute and chronic low back pain were 42.07 ± 14.28, 41.50 ± 11.91, 48.78 ± 14.42 respectively (P ≈ 0.002). (Table 4). The average VAS for male and female group were 52.83 ± 15.24 and 56.99 ± 13.12 respectively (p ≈ 0.059). The average NV-ODI for male and female group were 43.34 ± 14.94 and 45.42 ± 13.81 respectively (p ≈ 0.358). (Table 3). The average VAS for muslim and hindu groups were 56.33 ± 12 and 55.58 ± 14.99 respectively (p ≈ 0.708). The average NV-ODI for muslim and hindu groups were 45.45 ± 12.85 and 44.46 ± 14.98 respectively (p ≈ 0.628). (Table 7).

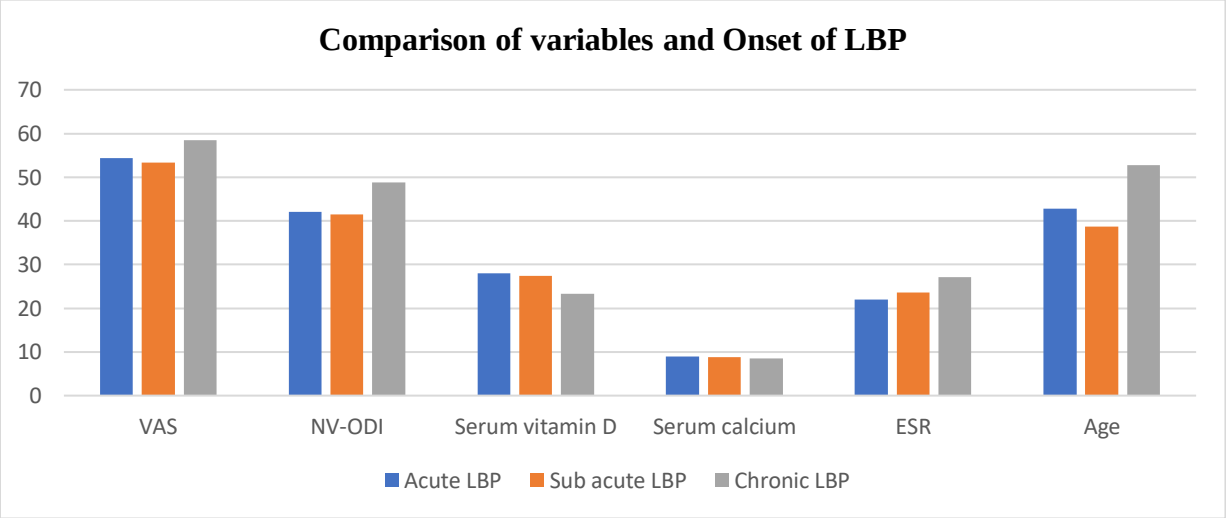

Figure 2. Comparison of variables among Onset groups (n=200)

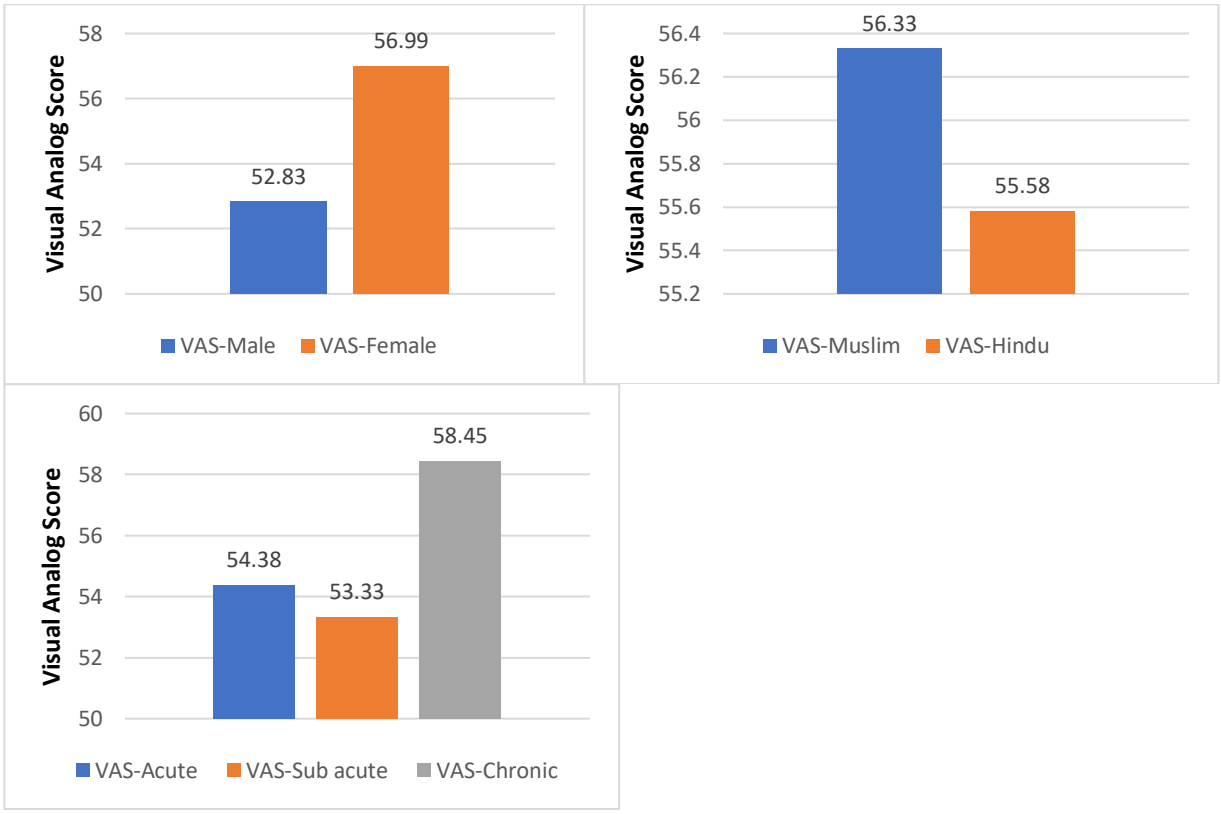

Figure 3. Comparison of VAS in Gender, Ethenicity, Onset groups (n=200)

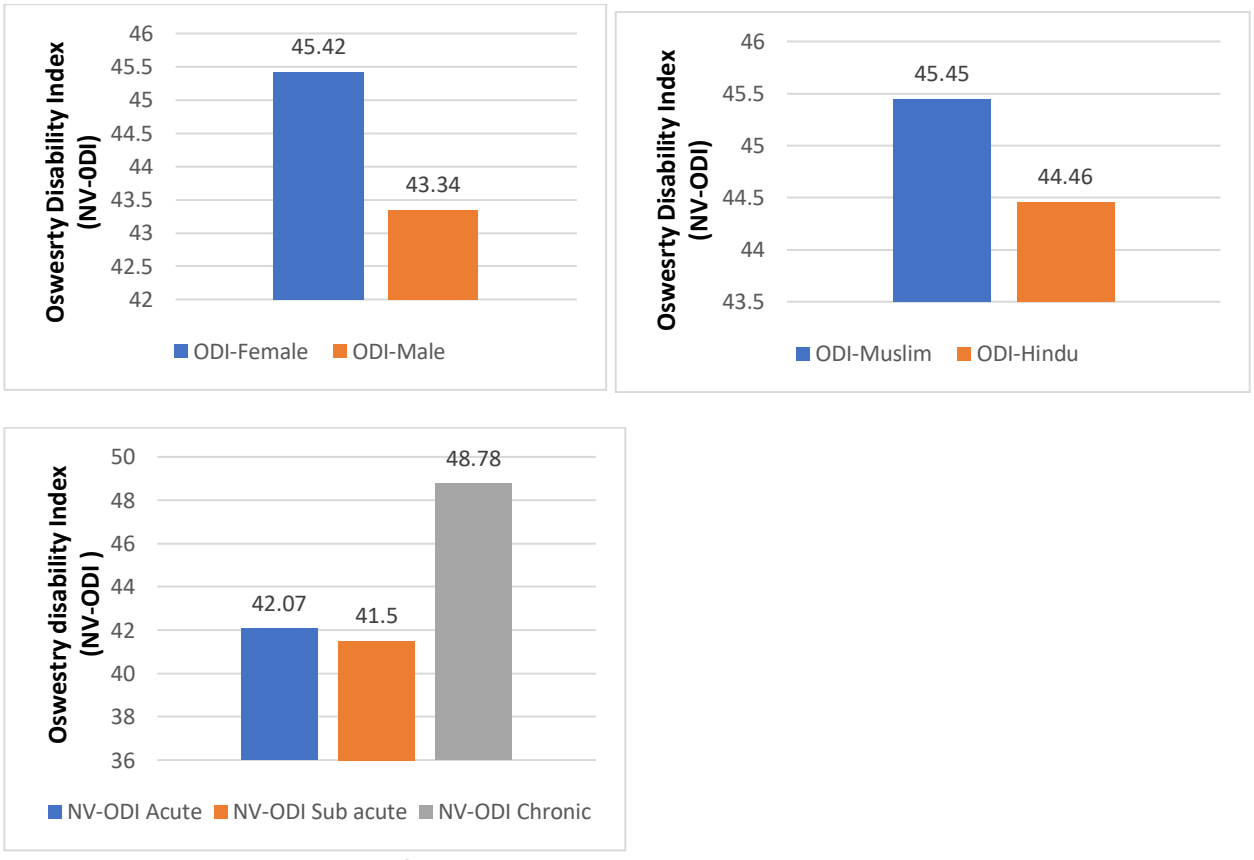

Figure 4. Comparison of NV-ODI in Gender, Ethenicity and Onset groups (n=200)

Table 5. Comparison of varaibles and C-reactive protein (n=200)

Variable	CRP	N	Mean	SD	SEM	p value
Age	≤6	191	46.05	14.51	1.05	0.919
	>6	9	46.56	12.75	4.25	
VAS	≤6	191	56.01	13.88	1.01	0.571
	>6	9	53.33	12.25	4.08	
NV-ODI	≤6	191	45.14	13.89	1.01	0.211
	>6	9	39.11	18.20	6.07	
Vitamin-D	≤6	191	25.89	8.78	0.64	0.257
	>6	9	22.49	8.38	2.79	
Calcium	≤6	189	8.68	1.05	0.08	0.479
	>6	9	8.43	0.65	0.22	
ESR	≤6	191	24.62	6.26	0.45	0.984
	>6	9	24.67	6.21	2.07	

Table 6. Comparison of Gender, Onset of LBP and Ethenic group(n=200)

Characteristic	Category	CRP		p-value
		≤6	>6	
Gender	Male	52	1	0.284
		98.1%	1.9%	
	Female	139	8	
		94.6%	5.4%	
Ethnicity	Hindu	111	6	0.611
		94.9%	5.1%	
	Muslim	80	3	
		96.4%	3.6%	
LBP Onset	Sub-acute	53	1	0.019
		98.1%	1.9%	
	Acute	58	0	
		100.0%	0.0%	
	Chronic	80	8	
		90.9%	9.1%	

Table 7. Comparison of variables and ethnic groups (n=200)

Variable	Ethnicity	N	Mean	SD	sem	p-value
Age	Hindu	117	47.15	14.21	1.31	0.210
	Muslim	83	44.55	14.64	1.61	
VAS	Hindu	117	55.58	14.99	1.39	0.708
	Muslim	83	56.33	12.00	1.32	
ODI	Hindu	117	44.46	14.98	1.39	0.628
	Muslim	83	45.45	12.85	1.41	
Vitamin-D	Hindu	117	25.09	7.41	0.68	0.218
	Muslim	83	26.65	10.37	1.14	
Calcium	Hindu	116	8.67	1.15	0.11	0.952
	Muslim	82	8.68	0.85	0.09	
ESR	Hindu	117	24.44	6.36	0.59	0.628
	Muslim	83	24.88	6.10	0.67	

4. Discussion

Gokcek E et al.[10] reported population with low back pain had vitamin D deficiency ratio of about 71.7%. In our study 79% of population with low back pain had vitamin D deficiency and 21% with normal range of serum vitamin D. Ghai B et al.[20] reported that there were no significant correlation between serum vitamin D level and severity of low back pain. However, Lotfi A et al.[27] demonstrated that there was a significant correlation between serum vitamin D and pain severity. Only few studies regarding the relationship between D vitamin and pain severity were found in literature review. The data obtained in our study find out the correlation between the severity of pain and the serum vitamin D in patients with LBP. Patients with all the onset of LBP had lower serum vitamin D level, lower concentration of serum calcium and higher inflammatory marker levels like ESR but not obvious change in CRP level. Forrest KY et al.[26] reported the average prevalence in vitamin D deficiency in the USA was reported as 41.6%, which was 82.1% in black people and 69.2% in Hispanics. Our study noticed prevalence of LBP was high among the individual with low level of serum vitamin D and low concentration of serum calcium. The disability score was higher in case of chronic onset leading to more severity of LBP as compared to acute and sub-acute LBP. This association between low vitamin D and LBP may be mediated by inflammatory mediators. Patients with LBP had a deficiency of Vitamin D and that there was a positive correlation between the level of Vitamin D and pain severity. Zadro J et al.[11] found that patients with LBP had lower serum vitamin D and more common in younger women. We also found that Vitamin D level in female patients with LBP were lower than that of male patients and more common in middle age women (44.93 ± 13.66 years) but not statistically significant. The severity and disability score in middle age female were high as compared to male as well as lower level of serum calcium and higher level of inflammatory marker like ESR. The severity and disability score among Muslim group were high as compared to Hindu group. The serum level of vitamin D was higher than that of Hindu group but no difference in the serum level of serum calcium and inflammatory marker like CRP and ESR. The serum level of vitamin D in chronic LBP was lower than that of acute and sub-acute LBP. There were no obvious difference in serum concentration of calcium among the acute and sub-acute LBP. There were no obvious difference between among the different onset of LBP and in the serum level of calcium whereas the level of ESR was higher in chronic LBP group as compared to acute and sub-acute LBP group. There are

several limitations to this study like underlying factors such as age, race, sociodemographic, dietary conditions, bone density, exposure to sun light. However, such types of studies had not been conducted in eastern terai of nepal. Further studies are still required.

In our study of 200 patients with low back pain showed positive correlation between the serum level of vitamin D and severity and prevalence of low back pain. The average number of patients with low back pain among Hindu religion (73.5%) were higher than that of Muslim religion (41.5%). The average VAS, NV-ODI, serum vitamin D, serum calcium level and concentration of ESR were 55.89% ± 13.80, 44.87 ± 14.11, 25.74 ± 8.77, 8.67 ± 1.03 and 24.63 ± 6.24 respectively. (Table 1). The average age of female patients with LBP was (44.93 ± 13.66, $p \approx 0.060$) younger than that of male patients (49.26 ± 16.03, $p \approx 0.060$). The mean VAS among female patients (56.99 ± 13.12, $p \approx 0.059$) were higher than that of male patients (52.83 ± 15.24, $p \approx 0.059$). The mean NV-ODI among female patients (45.42 ± 13.81, $p \approx 0.358$) were higher than that of male patients (43.34 ±14.94, $p \approx 0.358$). The average serum vitamin D level for female patients (25.37± 9.04, $p \approx 0.322$) was lower than that of male patients (26.76 ± 7.97, $p \approx 0.322$). There were no difference in average serum calcium concentration for both female (8.63 ± 0.99, $p \approx 0.348$) and male (8.79 ± 1.15, $p \approx 0.348$) patients. The average concentration of ESR in female patients (25.31 ± 5.52, $p \approx 0.010$) was higher than that of male patients (22.74 ± 7.67, $p \approx 0.010$). The patients were divided into three groups on the basis of onset of disease. The clinical presentation of patients with chronic low back pain (44%) was highest among all followed by acute (29%) and sub-acute (27%) low back pain. Among 83 Muslim patients with low back pain, the number of patients with acute, sub-acute and chronic LBP were 20 (24.09%), 25 (30.12%) and 38 (45.78%) respectively. Among 117 Hindu patients with low back pain the number of patients with acute, sub-acute and chronic LBP were 39 (33.33%), 28 (23.93%) and 50 (42.73%) respectively. There were no difference between the average concentration of serum calcium among the patients belongs to Muslim (8.68 ±0.85, $p \approx 0.952$) and Hindu (8.67 ± 1.15, $p \approx 0.952$) religion. The average level of serum vitamin D among Muslim patients (26.65 ± 10.37, $p \approx 0.218$) were higher than that of Hindu (25.09 ± 7.41, $p \approx 0.218$) religion. The mean VAS among Muslims patients (56.33 ± 12, $p \approx 0.708$) were higher than that of Hindu (55.58 ±14.99, $p \approx 0.708$) religion. The mean NV-ODI among Muslim patients (45.45 ±12.85, $p \approx 0.628$) were higher than that of Hindu (44.46 ±14.98, $p \approx 0.628$) religion. There were no obvious difference between average concentration of ESR among Muslims patients (24.88 ± 6.10, $p \approx 0.628$) and Hindu (24.88 ± 6.10, $p \approx 0.628$) religion.

5. Conclusion

In conclusion, the prevalence of LBP is high among the individual with low level of serum vitamin D level and low level of serum calcium concentration. There is positive correlation between the serum vitamin D level and severity of low back pain. The disability score is high among the individual with chronic onset leading to more severity of low back pain. Middle aged female population are highly affected with higher severity and disability score. Disability score among the muslim group is higher as compare to hindu group reflecting to more severity of low back pain among them. Therefore, further large scale study needed to investigate the relation between severity of low back pain and vitamin D and its relation with inflammatory mediators to reduce the prevalence of LBP.

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Annex 1

Pro forma

Correlation between vitamin D and Low back pain in a person of eastern Terai of Nepal.

Study No.: Hospital ID: In patient ID: Date:

Particulars

Name: Age: Gender: Ethnicity:

Occupation: Marital Status: Contact No.:

Address:

CLINICAL HISTORY:

- Symptoms of LBP, duration:
- Site of pain and suspected fracture:
- ASIA Score:
- Presence of neurological symptoms (altered sensation/ weakness/numbness): (+/-)
- LS tenderness: (+/-)
- Neurological deficit;
- Motor weakness: (L2, L3, L4, L5, S1)

 Tibialis anterior: L4

 EHL: L5

 FHL: S1

- Sensory deficit: dermatome level (L2, L3, L4, L5, S1)
- Reflexes:

 Knee (L2, 3, 4):

 Ankle (S1):

- Bowel and bladder involvement: (+/-)
- Level of fracture diagnosed with x ray radiographs

LBP (Duration)	VAS score	ODI score	Serum Vitamin D level	Serum Calcium level	C-reactive protein (CRP)	Erythrocyte sedimentation rate (ESR)
Acute (<6weeks)						
Sub-acute (6-12weeks)						
Chronic (>12 weeks)						

Annex 2

<u>मञ्जुरीनामा पत्र</u>

मिति.....

मेरो नाम **<u>डा.पुष्कर निरौला</u>** हो । म सप्तकोशी न्यूरोअस्पताल प्रा.लि. इनरुवाको हाडजोर्नी तथा स्पाइन विभागमा कार्यरत छु । मैले **Correlation between vitamin D and low back pain in a person of eastern Terai of Nepal at Saptakoshi Neuro Hospital, Inaruwa** बिषयमा अध्ययन गर्न गइरहेको छु । म यस अनुसन्धानको जानकारी दिन साथसाथै यसको अंश बनिदिनुहुन सादर अनुरोध गर्दछु। तपाईको संलग्ता यस अध्ययन मा स्वेच्छिक हुनेछ र तपाई निसंकोच कुनै पनि बखत यस अध्ययनबाट बाहिरिन सक्नु हुनेछ। तपाईंलाई यसै बखत निर्णय गर्नुपर्ने बाध्यता छैन। यसमा निर्णय गर्नु पूर्व तपाईं आफुलाई सहज लाग्ने व्यक्तिसँग सल्लाह लिन सक्नुहुन्छ। तपाईं यस अध्ययनको अंश बनेवापत मलाइ कुनै आर्थिक लाभ हुने छैन र तपाइँको व्यक्तिगत विवरणहरु गोप्य नै रहनेछन्। जानकारीमा कहीँ कतै नबुझेको खण्डमा मलाई सम्पर्क गर्नुहुन अनुरोध गर्दछु। यदि केहि प्रश्नरहेमा मलाई वा विशेषज्ञ वा कर्मचारीलाई सोध्नुहुन अनुरोध गर्दछु।

धन्यवाद।

मलाई यस अध्ययन सम्बन्धी सम्पूर्ण रुपमा जानकारी गराइएको छ र म यस अध्ययनमा स्वेच्छाका साथ संलग्न हुन मञ्जुर छु।

दस्तख: साक्षीको दस्तखत:

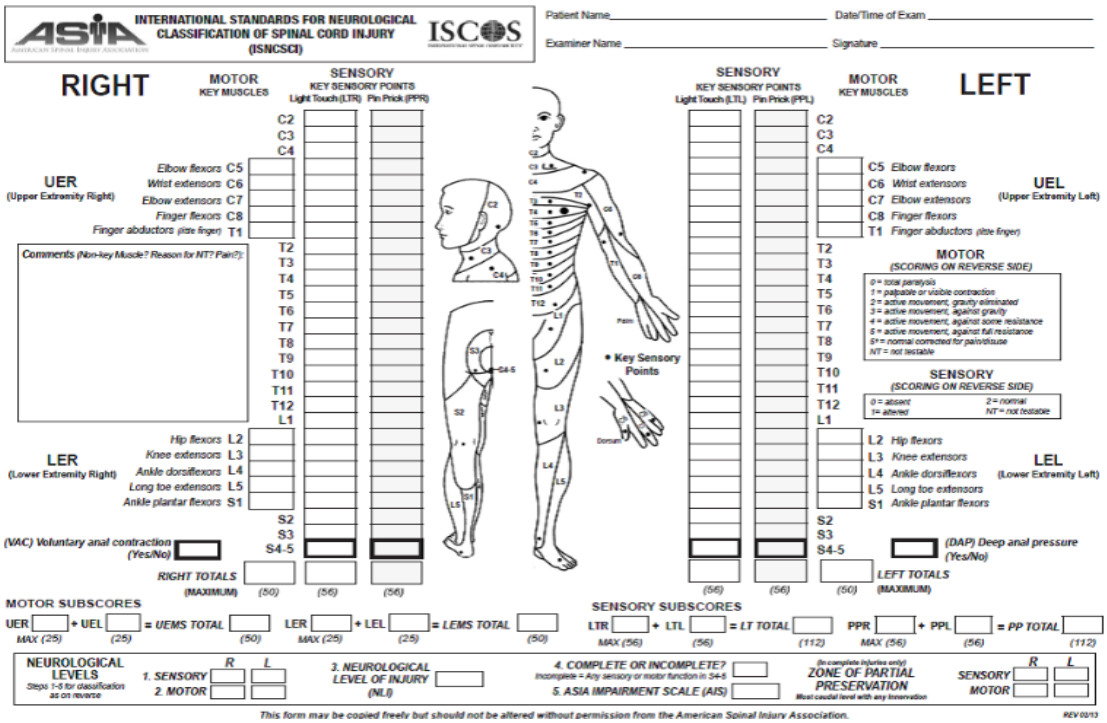
नाम:

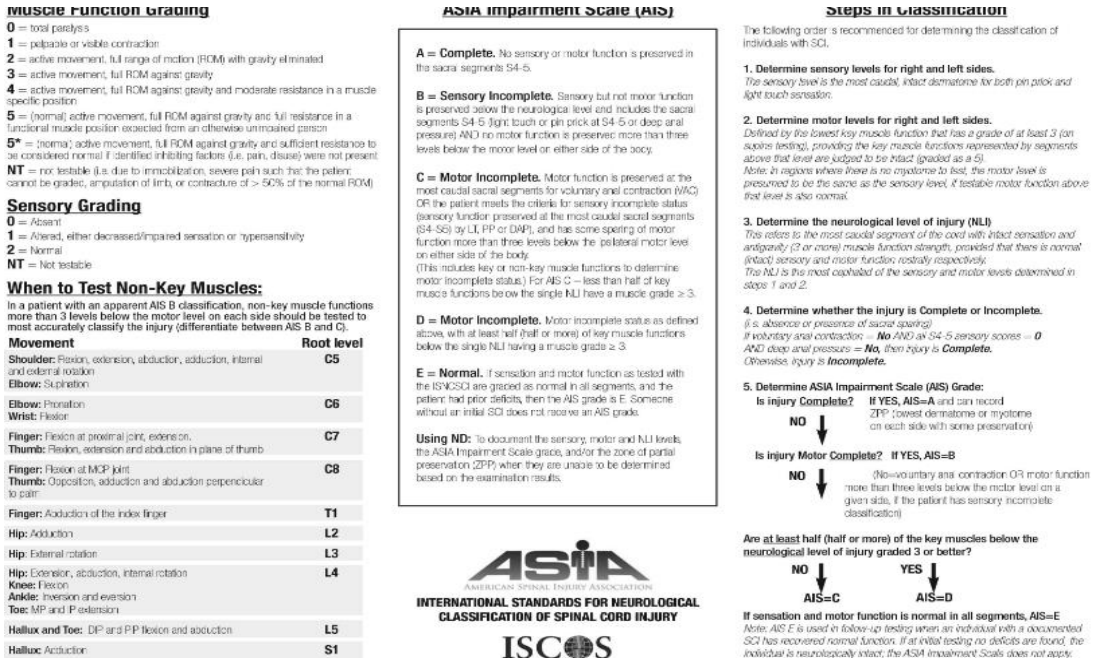
ठेगान:

फोन न:

दायाँ बायाँ

Annex 3





Muscle Function Grading

0 = total paralysis
1 = palpable or visible contraction
2 = active movement, full range of motion (ROM) with gravity eliminated
3 = active movement, full ROM against gravity
4 = active movement, full ROM against gravity and moderate resistance in a muscle specific position
5 = (normal) active movement, full ROM against gravity and full resistance in a functional muscle position expected from an otherwise unimpaired person
5* = (normal*) active movement, full ROM against gravity and sufficient resistance to be considered normal if identified inhibiting factors (i.e. pain, disuse) were not present
NT = not testable (i.e. due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of > 50% of the normal ROM)

Sensory Grading

0 = Absent
1 = Altered, either decreased/impaired sensation or hypersensitivity
2 = Normal
NT = Not testable

When to Test Non-Key Muscles:

In a patient with an apparent AIS B classification, non-key muscle functions more than 3 levels below the motor level on each side should be tested to most accurately classify the injury (differentiate between AIS B and C).

Movement	Root level
Shoulder: Flexion, extension, abduction, adduction, internal and external rotation **Elbow:** Supination	C5
Elbow: Pronation **Wrist:** Flexion	C6
Finger: Flexion at proximal joint, extension **Thumb:** Flexion, extension and abduction in plane of thumb	C7
Finger: Flexion at MCP joint **Thumb:** Opposition, adduction and abduction perpendicular to palm	C8
Finger: Adduction of the index finger	T1
Hip: Adduction	L2
Hip: External rotation	L3
Hip: Extension, abduction, internal rotation **Knee:** Flexion **Ankle:** Inversion and eversion **Toe:** MP and IP extension	L4
Hallux and Toe: DIP and PIP flexion and abduction	L5
Hallux: Adduction	S1

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved at the most caudal sacral segments for voluntary anal contraction (VAC) OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments (S4-S5) by LT, PP or DAP), and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body.
(This includes key or non-key muscle functions to determine motor incomplete status.) For AIS C – less than half of key muscle functions below the single NLI have a muscle grade ≥ 3.

D = Motor Incomplete. Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the single NLI having a muscle grade ≥ 3.

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

Using ND: To document the sensory, motor and NLI levels, the ASIA Impairment Scale grade, and/or the zone of partial preservation (ZPP) when they are unable to be determined based on the examination results.

ASIA
AMERICAN SPINAL INJURY ASSOCIATION
INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY
ISCOS

Steps in Classification

The following order is recommended for determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides.
The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides.
Defined by the lowest key muscle function that has a grade of at least 3 (on supine testing), providing the key muscle functions represented by segments above that level are judged to be intact (graded as a 5).
Note: In regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level, if testable motor function above that level is also normal.

3. Determine the neurological level of injury (NLI)
This refers to the most caudal segment of the cord with intact sensation and antigravity (3 or more) muscle function strength, provided that there is normal (intact) sensory and motor function rostrally respectively.
The NLI is the most cephalad of the sensory and motor levels determined in steps 1 and 2.

4. Determine whether the injury is Complete or Incomplete.
(i.e. absence of sacral sparing)
*If voluntary anal contraction = **No** AND all S4-5 sensory scores = **0** AND deep anal pressure = **No**, then injury is **Complete.***
*Otherwise, injury is **Incomplete.***

5. Determine ASIA Impairment Scale (AIS) Grade:
Is injury Complete? **If YES, AIS=A** and can record ZPP (lowest dermatome or myotome on each side with some preservation)
NO ↓
Is injury Motor Complete? **If YES, AIS=B**
NO ↓ (No=voluntary anal contraction OR motor function more than three levels below the motor level on a given side, if the patient has sensory incomplete classification)

Are at least half (half or more) of the key muscles below the neurological level of injury graded 3 or better?
NO ↓ **AIS=C** YES ↓ **AIS=D**

If sensation and motor function is normal in all segments, AIS=E
Note: AIS E is used in follow-up testing when an individual with a documented SCI has recovered normal function. If at initial testing no deficits are found, the individual is neurologically intact; the ASIA Impairment Scale does not apply.

Annex 4

असवेष्ट्री असक्तता प्रश्नावली

यो प्रश्नोतर तपाईको ढाड वा खुट्टा दुखाईले तपाईको दैनिक जीवनमा व्यवस्थित गर्ने क्षमतालाई कसरी प्रभाव पारिरहेछ भन्ने सम्बन्धमा जानकारी दिनको लागी तयार गरिएको हो । प्रत्येक खण्ड एउटा बाकसलाई आफुलाई अनुकुल हुने वाक्यांशलाई छानेर उत्तर दिनुहोला । हामी अनुभव गर्न सक्छौ कि तपाइलाई कुनै एक खण्डको दुई वा सो भन्दा बढी वाक्यांश लागु हुन सक्छ तर कृपया तपाईको समस्यालाई सबैभन्दा प्रष्टसित प्रस्फुटन गर्छ त्यसलाई छायाँ दिनु होला ।

खण्ड १ दुखाईको मात्रा

- ☐ अहिले मलाई दुखेको छैन ।
- ☐ अहिले मलाई अलि अलि मात्र दुखेको छ ।
- ☐ अहिले मलाइ सामान्य दुखेको छ ।
- ☐ अहिले मलाई अलि बढि दुखेको छ ।
- ☐ अहिले मलाई एकदम तिब्र दुखेको छ ।
- ☐ अहिले मलाई सोच्नै नसकिने गरि दुखेको छ ।

खण्ड २ व्यक्तिगत हेरचाह (नुहाउने, लुगा लगाउने आदि)

- ☐ म आफ्नो साधारण हेरचाह थप दुखाई बिना आफै गर्न सक्छु ।
- ☐ म आफ्नो साधारण हेरचाह आफै गर्न सक्छु , तर यसले थप दुखाई हुन्छ ।
- ☐ मलाई आफ्नो हेरचाह गर्दा दुख्छ र म विस्तारै र होसियारपूर्वक गर्छु ।
- ☐ मलाई केही सहयोगको आवश्यकता छ , तर मेरा धेरै जसो हेरचाह आफै गर्न सक्छु ।
- ☐ व्यक्तिगत हेरचाहको धेरै जसो प्रसंगमा मलाई प्रत्येक दिन सहयोग चाहिन्छ।
- ☐ म आफै लुगा लगाउन सक्दिन कठिनाई का साथ धुन्छु र ओह्यानमै बसिरहन्छु।

खण्ड ३ उचाल्दा

	म गह्रौं सामानहरु थप दुखाई बिना उचाल्न सक्छु ।
	म गह्रौं सामानहरु उचाल्न सक्छु तर यसले थप दुखाई दिन्छ ।
	दुखाईले मलाई भुइँको गह्रौं सामानहरु उचाल्न रोक्छ तर सामानहरु सुविधाजनक ठाउँमा राखिएका छन् भने उठाउन सक्छु जस्तै कुर्सिमा राखिएका सामानहरु ।
	दुखाईको कारणले गह्रौं सामानहरु उचाल्न सक्दिन तर तिनिहरु हलुका छन् र सुविधाजनक ठाउँमा राखिएका छन् भने उठाउन सक्छु ।
	म एकदम हल्का खालका सामानहरु मात्र उचाल्न सक्छु ।
	म कुनैपनि सामानहरु उठाउन वा बोक्न सक्दिन ।

खण्ड ४ हिंडडुल

	दुखाईले मलाई कुनै पनि दुरी सम्म हिड्न रोक्दैन ।
	दुखाईले मलाई २ किलोमिटर दुरी भन्दा बढि हिड्न रोक्छ ।
	दुखाईले मलाई १ किलोमिटर दुरी भन्दा बढि हिड्न रोक्छ ।
	दुखाईले मलाई ५०० मिटर दुरी भन्दा बढि हिड्न रोक्छ ।
	म लट्ठि वा बैशाखी प्रयोग गरेर मात्र हिड्न सक्छु ।
	म धेरैजसो समय ओछ्यानमा नै हुन्छु र घिस्रिएर शौचालय जानु पर्छ ।

खण्ड ५ बस्दा

	म आफुले चाहेको समय जति कुनै पनि कुर्सिमा बस्न सक्छु ।
	म आफुले चाहेको समय जति मेरो मनपर्ने कुर्सिमा बस्न सक्छु ।
	दुखाईले मलाई १ घण्टा भन्दा बढि बस्नबाट रोक्छ ।
	दुखाईले मलाई ३० मिनेट भन्दा बढि बस्नबाट रोक्छ ।
	दुखाईले मलाई १० मिनेट भन्दा बढि बस्नबाट रोक्छ ।
	दुखाईले गर्दा म केही समय पनि बस्न सक्दिन ।

खण्ड ६ उभिदा

	म आफुले चाहेको समय जति थप दुखाई बिना उभिन सक्छु ।
	म आफुले चाहेको समय जति बिना दुखाई उभिन सक्छु तर यसले थप दुखाई दिन्छ ।
	दुखाईले मलाई १ घण्टा भन्दा बढि उभिनबाट रोक्छ ।
	दुखाईले मलाई ३० मिनेट भन्दा बढि उभिनबाट रोक्छ ।
	दुखाईले मलाई १० मिनेट भन्दा बढि उभिनबाट रोक्छ ।
	दुखाईले गर्दा म केही समय पनि उभिन सक्दिन ।

खण्ड ७ सुत्दा

	दुखाईले गर्दा मेरो निन्द्राकहिलै पनि अवरोध हुदैन ।
	दुखाईले गर्दा मेरो निन्द्रा कहिले काहिं अवरोध हुन्छ ।
	दुखाईको कारणले गर्दा म ६ घण्टा भन्दा कम सुत्छु ।
	दुखाईको कारणले गर्दा म ४ घण्टा भन्दा कम सुत्छु ।
	दुखाईको कारणले गर्दा म २ घण्टा भन्दा कम सुत्छु ।
	दुखाईले गर्दा म केहि समय पनि सुत्न सक्दिन ।

खण्ड ८ यौन जीवन (सम्बन्धित व्यक्तिको लागी)

	मेरो यौन जीवन साधारण छ र यसको कारणले थप दुखाई हुदैन ।
	मेरो यौन जीवन साधारण छ तर यसको कारणले केहि दुखाई हुन्छ ।
	मेरो यौन जीवन साधारण छ र यसको कारणले अति धेरै दुखाई हुन्छ ।
	मेरो यौन जीवन दुखाईले गर्दा अति नै प्रभावित छ ।
	दुखाईले मेरो यौन जीवन लगभग छैन ।
	दुखाईको कारणले मेरो यौन जीवन पटक्कै छैन ।

खण्ड ९ सामाजिक जीवन

	मेरो सामाजिक जीवन साधारण छ र थप पिडा पनि हुदैन ।
	मेरो सामाजिक जीवन सामान्य छ तर दुखाईको स्तर बढ्छ ।
	मेरो इच्छाको कामहरु जस्तै खेलकुद वाहेक दुखाईले मेरो सामाजिक जीवनलाई उल्लेखनीय प्रभाव पारेको छैन ।
	दुखाईले मेरो सामाजिक जीवन सिमित भएको छ र म धेरै जसो बाहिर
	जान्न दुखाईले मेरो सामाजिक जीवनलाई घरमा नै सिमित गरेको छ ।
	दुखाईले गर्दा मेरो सामाजिक जीवन छैन ।

खण्ड १० यात्रा

	म विना दुखाई जहाँ पनि यात्रा गर्न सक्छु ।
	म जहाँ पनि यात्रा गर्न सक्छु तर यसले थप दुखाई दिन्छ ।
	मेरो दुखाई नराम्रो छ तर म २ घण्टा भन्दा बढिको लागि व्यवस्था गर्न सक्छु ।
	दुखाईले मेरो १ घण्टा भन्दा कमको यात्रा गर्न बाट पनि अवरोध गर्छ ।
	दुखाईले मेरो ३० मिनेट भन्दा कमको छोटो आवस्यक यात्रा गर्न बाट पनि अवरोध गर्छ ।
	दुखाईले मेरो उपचार गराउन वाहेक अरु यात्रा गर्न बाट अवरोध गर्दछ ।

Abbreviations

SNH	Saptakoshi Neuro hospital
BMI	Body Mass Index
LBP	Low back pain
ESR	Erythrocyte Sedimentation Rate
NSLBP	Nonspecific low back pain
CRP	C-reactive protein
NV-ODI	Nepali version Oswestry Disability Index
VAS	Visual Analog Scale
TL	Thoracolumbar
OPD	Out Patient Department
NSAID	Nonsteroidal anti-inflammatory drugs
NV	Nepali Version