

Original Article

Effect of Electroacupuncture in Neurogenic Bladder: A Quasi-Experimental Study

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Abstract: Neurogenic bladder (NB) is the dysfunction of either the urinary bladder, bladder neck or its sphincters due to diseases of the peripheral or central nervous system involved in the control of micturition or urination. There are two types of neurogenic bladder. One is overactive bladder and another is underactive bladder. Acupuncture has certain effective role in treating bladder dysfunction including urinary retention and incontinence. This study used to explore the effectiveness of electroacupuncture in patients with neurogenic bladder and compare the difference in improvement of urological symptoms of overactive and underactive bladder symptoms along with quality of life assessed by NBSS score between the case and control group. This was a quasi-experimental study with non-probability convenient sampling. The overactive bladder issues along with incontinence were taken care by parameters (Day time frequency, saturation of pads, number of pads, nocturnal incontinence, skin problem, limits of activities, interval without leakage, liquid restriction) of NBSS score and the results were found to statistically significant ($p < 0.05$) on case group. The underactive bladder issues along with storage and voiding problems were taken care by parameters (Frequency of urge, Urgency, Nocturia, Longest interval, post void fullness, stream, and straining) of NBSS score and the results were found to statistically significant ($p < 0.05$) on case group. The consequences parameter (Pain and UTI) of neurogenic bladder for both underactive and overactive bladder were found to statistically significant ($p < 0.05$) on case group as compared with control group. The quality of life parameter from NBSS score was statistically significant ($p < 0.05$) in case group as compared with control group. The results of the present study suggest that for thirty minutes of acupuncture in Sanyinjiao (SP6), Yinlingquan (SP9), Qugu (CV2), Zhongji (CV3), Qihai (CV6), Shenshu (BL23), Pangguanshu (BL28), Baihui (GV20), Zhaohai (KL6), Zhongliao (BL33), Xialiao (BL34), Guanyuanshu (BL26) and electroacupuncture in Ciliao (BL23 and Shuidao (ST28) six times a week for three weeks along with conventional management is very effective in improving symptoms of both overactive and underactive bladder issues. Evidence suggests that EA is the vital components in treating NB issues so it should be taken into considerations while treating neurogenic bladder problems.

Keywords: electroacupuncture, neurogenic bladder, spinal cord injury, clinical trial

1. INTRODUCTION

Neurogenic bladder refers to the dysfunction of urinary bladder secondary to the disease of nervous system that result in problem with urinary storage, micturition, or both [1]. The etiology of neurogenic bladder is found to be mainly due to disease of CNS and PNS involved in control of micturition. The site of the neurological lesion and its nature influence the pattern of dysfunction. Development of upper urinary tract damage and renal failure is considered as main complications of neurogenic bladder dysfunction. Many patients with neurological conditions are complicated by neurogenic bladder dysfunction. The mean age of neurogenic bladder patients is 62.5 (standard deviation 19.6) years. The prevalence of neurogenic bladder in Parkinson's disease ranges between 38 and 71%, depending on the extent and duration of disease, 40-90% in MS (Multiple sclerosis) patients, 70-84% in patients with spinal cord injury and 15% in patient with stroke and diabetic neuropathy [2]. Treatment of neurogenic bladder includes anticholinergic drugs, botox injection, antibiotics and CIC. Antimuscarinic agents, Beta-3 adrenergic receptors agonists are commonly used to manage storage problems but these have adverse effects like dry mouth, headache, constipation, dizziness, urinary retention, altered consciousness and cognition alterations, palpitations etc. [3]. Second line treatments like Botulinum toxin and neuromodulation methods are highly effective for managing overactive bladder problems but they are invasive and expensive and can require long-term follow up [4]. For voiding dysfunctions intermittent catheterization is the best option. Clean intermittent self-catheterization is preferable to an indwelling catheter, however, if this is not possible, then a supra pubic indwelling catheter is preferable to a urethral catheter for long-term management [5]. Recent study in 2022 showed that there are commonest difficulty among all patients who was practicing CIC in outdoor environments is due to the unavailability of toilet facilities and this study also found urinary tract infection was the most common complication and there was CIC dependence, pain as well as procedural difficulty [6]. It is found that all of these treatment are not able to provide satisfactory results. Electroacupuncture is the up growing popular forms of intervention, increasingly used in clinical and in experimental research, which is safe and cheap in producing the positive impacts in NB [7]. Epidemiology of Parkinson's disease in global world is found to be 150/100000 people, epidemiology of Cerebro vascular injuries is 1995-2416/100000 in developing countries. Epidemiology of Multiple sclerosis is 60-100/100000 in western countries, whereas global prevalence of spinal cord injury is between 236 and 1009/100000 people. Nepal is listed in least developed country by UN and has been facing challenges to fulfill basic needs like food and habitat as well as mental health issues followed by chronic neurological illness like hemiplegia, paraplegia and neurogenic bladder [8]. In Nepal very few retrospective studies had been conducted for epidemiology of neurogenic bladder but exact data is not available. Acupuncture is a key component of traditional Chinese medicine mostly used for pain management and neurological issue. Acupuncture has long history more than 3000 years of practice in China and in different countries in recent years. It has been increasing integrated with western medicine and gaining popularity and acceptance in public and healthcare professionals globally. World Health Organization (WHO) has recommended this technique for a wide range of conditions, e.g., pain, musculoskeletal disorders, cerebrovascular diseases, and several neurological ailments including neurogenic bladder [9]. Electroacupuncture involving the lumbosacral region could cause muscle contraction and stimulate pelvic floor muscle training. Electroacupuncture may stimulate S3 via BL33 and the pudendal nerve via BL35 at the lumbosacral region. Thus, electroacupuncture facilitate the reinnervation and strengthening of pelvic floor muscles, improving symptoms like urinary incontinence. The acupoints chosen for electroacupuncture in neurogenic bladder are Shenshu(BL23), Pangguangshu(BL28), Ciliao(BL32), Guanyuanshu(BL26), Shangliao(BL31), Zhongliao(BL33), Xiaoliao(BL34), Zhongji(CV3), Qihai(CV6), Guanyuan(CV4), Sanyinjiao(SP6), Shuidao(ST28), Zhaohai(KI6), Baihui (GV20). Acupoints that are located in bladder meridian like BL23, BL28,

BL31, BL32 and BL33 are located at second lumbar, fourth lumbar, first, second and third sacral foramina from where first, second and third sacral nerve root arises, these correspond with the segmental innervation of parasympathetic nerve supply to bladder [10]. These acupoints correspond with the origin of the somatic fibers of the pudendal nerve, which provide excitatory innervation to the pelvic floor muscles and the sphincter so that they are able to remain in a contracted state. Similarly, Qihai (CV6), Guanyuan (CV4), corresponds to the skin dermatomes from T11-L1. Since the afferent and efferent innervations of the bladder are affected by the sympathetic nerves originating at T11-L2, as well as the parasympathetic and somatic nerves originating at S2- S4 [11]. Dysfunction due to neurological problems has been increasing tremendously worldwide. The impact of the disease results in long term disability, increase risk of urinary complications and ultimately reducing quality of life [12]. Interventions like electroacupuncture have been found to be rehabilitative measure in neurological disorder including neurogenic bladder. Neurogenic bladder dysfunction due to neurological problems has been increasing tremendously worldwide. The impact of the disease results in long term disability, increase risk of urinary complications and ultimately reducing quality of life [13]. Treatment of neurogenic bladder includes anticholinergic drugs, Botox injection, antibiotics and CIC. Antimuscarinic agents, Beta-3 adrenergic receptors agonists have adverse effects like dry mouth, headache, constipation, dizziness, urinary retention, altered consciousness and cognition alterations, palpitations. Second line treatments like Botulinum toxin and neuromodulation methods though effective for managing overactive bladder problems but they are invasive and expensive and can require long- term follow up. Though intermittent catheterization is the best option but procedural complication like pain and frequent urinary tract infections are frequently observed among patients. Recent study in 2022 showed that all patients feel difficulty in practicing CIC in outdoor environments due to the unavailability of toilet facilities [14]. Management of NBD requires a multidisciplinary approach and even health care professional are unaware about the role of acupuncture in the management NBD. There are only few studies done in South-Asia region, only few case reports from one country or a part of a country are available, that do not allow for reliable conclusion. This is the first clinical trial assessing the therapeutic effect of EA among the patient having the neurogenic bladder problems in Nepal. Thus, this study aims to determine the role of Electroacupuncture in NBD if shown effective then it would boon for patient in gaining early function and strength in individuals with NBD in Nepal. To assess the difference in symptoms of underactive bladder issues assessed by NBSS score between the intervention and control group. To assess the difference in consequences of Neurogenic bladder using NBSS Scores. To assess the difference in quality of life between intervention and control group.

2. MATERIALS & METHOD

Total 60 cases who had already been diagnosed with neurogenic bladder problems via neurologist were selected from cases who were admitted and visited the Annapurna Neurological Institute and Allied Sciences (ANIAS) and Central Ayurveda Hospital Naradevi. They were assigned into two groups after checking the inclusion and exclusion criteria. This trial was conducted as quantitative research with interventional design where there was gathering quantifiable data in the form of NBSS (Neurogenic bladder symptoms score) and performing statistical analysis via paired t-test and chi-square test. Sixty study samples were chosen from the general population. This trial was prospective design where the data were collected in a longitudinal pattern and watched them over the period for the development of outcome in the form of improvement of bladder symptoms within 21 days. The trial performed was non random sampling i.e., convenient sampling technique. Further, the trial used control group for comparison and reference in the case group. The sample chosen in this trial was non probability sampling technique method form of convenience sampling. The case who had visited first to the hospital was enrolled into the case and the next case was chosen as control. This process was repeated till the numbers of cases were reached to sixty. Baseline evaluation was done. Total duration of

treatment per subject was 6 days a week for 3 weeks. Total daily session during the treatment was for 30 minutes. End-line assessment was conducted by Neuro Physician after the sessions were completed. In this group all the participants were treated via acupuncture along with conventionally as per the standard protocol followed by the hospital. The participants were categorized into overactive and underactive problems. Capsule Urim ax 0.4 mg (CIPLA INDIAN COMPANY) was given orally thirty minutes after meal once a day along with acupuncture treatment. For voiding dysfunctions acupuncture along with clean intermittent catheterization was advised and teacher to the participants. Indwelling catheter was used if participants were unable to perform CIC. All the prescribed medications were taken through the study period and were stopped once the symptoms improved. The prescribed acupoints were Sanyinjiao (SP6), Yinlingquan (SP9), Qugu (CV2), Zhongji (CV3), Qihai (CV6), Shenshu (BL23), Pangguanshu (BL28), Baihui (GV20), Zhaohai (KI6), Shuidao (ST28), Ciliao (BL23), Zhongliao (BL33), Xialiao (BL34), Guanyuanshu (BL26). Used acupoints were grouped as follows. Near by points: Qugu (CV2), Zhongji (CV3) and Qihai (CV6). Distant points: Sanyinjiao (SP6), Yinlingquan (SP9), Baihui (GV20) and Zhaohai (KI6)..Symptomatic points: Shenshu (BL23), Pangguanshu (BL28), Ciliao (BL23), Zhongliao (BL33), Xialiao (BL34), Guanyuanshu (BL26). The case group received acupuncture, six times a week (except Saturday) for three weeks. The follow-up period was after three weeks. Electroacupuncture was given in bilateral Ciliao (BL23), and acupoints located in abdominal region named Shuidao (ST28). Needling manipulation was as follows. Shenshu (BL23), Guanyuanshu (BL26) and Pangguanshu (BL28) were pierced perpendicularly 0.5-1cun, Ciliao (BL32), Shangliao (BL32), Zhongliao (BL33), and Xialiao (BL34) were pierced Perpendicularly 1.5cun while Zhongji (CV3), Qihai (CV6), Shuidao (ST28), Guanyuan (CV4) all were pierced perpendicular insertion of 1cun while Qugu (CV2) was pierced 0.5 cun perpendicularly. For distal points combination Sanyinjiao (SP6), Zhaohai (KI6), Yinlingquan (SP9) were used and yinlingquan was pierced 1.5 cun perpendicularly while Zhaohai and sanyinjiao were pierced 0.5 cun perpendicularly. In Baihui (GV20) transverse insertion of 0.5- 0.8 cun in backward direction was done. In all above acupoints the fundamental manipulation techniques were used. Lifting thrusting and twirling or rotating manipulation was done after 15 minutes with frequency of 50-60 per minute.

Table 01: Acupoints and Manipulation Techniques

Acupoint	Insertion	Angle	Depth	Manipultion
Shenshu (BL23)	single handed	Perpendicular	0.5 -1 cun	Lifting-thrusting twirling -rotating
Guanyuanshu (BL26)	single handed	Perpendicular	0.5 -1 cun	same as above
Pangguanshu (BL28)	"	"	"	"
Ciliao (BL32)	"	"	1.5 cun	"
Shangliao (BL32)	"	"	"	"
Zhongliao (BL33)	"	"	"	"
Xialiao (BL34)	"	"	"	"
Zhongji (CV3)	"	"	1 cun	"
Shuidao (ST28)	"	"	1 cun	"
Guanyuan (CV4)	"	"	"	"
Qihai (CV6)	"	"	"	"
Qugu (CV2)	"	"	0.5cun	"
Sanyinjiao (SP6)	"	"	"	"
Zhaohai (KI6)	"	"	"	"
Yinlingquan (SP9)	"	"	1.5 cun	"
Baihui (GV20)	"	Transverse	0.5-0.8 cun	twirling -rotating

For both type of underactive and overactive bladder problems, the acupoints selection was same. But only difference was the manipulation techniques.

Table 02: Overactive and Underactive bladder

Bladder Types	Used acupoints	Manipulation Technique
Overactive bladder	All above mentioned acupoints	Reducing manipulation
Underactive bladder	Same as above	Reinforcing manipulation

Table 03: Acupoints for Electroacupuncture

Stimulator model	Acupoints	Duration of stimulation	Current intensity	Waveforms	Frequency
Huatuo Brand SDZ-IIB	Ciliao (BL23)	30 minutes	0.1-1.0 mA	Continuous	10-20 times per minute
Same as above	Shuidao (BL32)	30 minutes	0.1-1.0 mA	Continuous	10-20 times per minute

In group b (control group) group all the participants were treated via conventionally as per the standard protocol followed by the hospital. The participants were categorized into overactive and underactive problems. capsule urimax 0.4 mg (cipla indian company) was given orally thirty minutes after meal once a day. the generic name of urimax is tamsulosin which is commonly used to treat the symptoms like difficulty urination, urine dribbling, frequent urination during night. for voiding dysfunctions clean intermittent catheterization was advised and teaches to the participants. indwelling catheter was used if participants were unable to perform cic. all the prescribed medications were taken through the study period and were stopped once the symptoms improved. proforma will be used to collect information about urgency, frequency, urge- incontinence, nocturia, feeling of incomplete emptying pre and post intervention in both case and control group. Neurogenic bladder symptoms score (nbss) was used to collect data in both intervention and control group prior and post-trial period. paired t-test will be used for data analysis. inter group comparison was done by chi square test.

3. RESULTS & DISCUSSION

Total 60 patients were screened in this study. Among them 30 subjects were enrolled in Group A or Case group (21 males and 7 females) who have received EA along with all the conventional treatment from ANIAS and Naradevi Ayurveda Hospital. In Group B or control group, 30 subjects (22 males and 8 females) received only conventional treatment from ANIAS and Ayurveda Hospital. Means and standard deviations were computed using measures of central tendency and measures of dispersion respectively. Kolmogorov-Smirnov test revealed the normal distribution of data. The intra-group comparison was performed using paired t-test. Data was analyzed without any adjustments in independent variable and covariates by using Chi-Square. Difference in differences was calculated after adjusting independent variables and covariates of each group NBSS for daytime frequency, number of pads, saturation of pads, nocturnal incontinence, liquid restriction, skin problems, limit of activities, frequency of urge, urgency, nocturia, longest interval, interval without leak, pain, post void fullness, stream, streaming, UTI frequency, UTI severity and quality of life respectively. The level of significance is considered to be <0.05.

Table 04: Classification of subjects according to the site of lesion

Case (30)		Control (30)	
Male (N=21)	Female (N=9)	Male (N=22)	Female (N=8)
Brain (N= 5)	Spinal (N=25)	Brain (N= 7)	Spinal (N= 23)

Table 05: The demographic data of subject group according to their ages

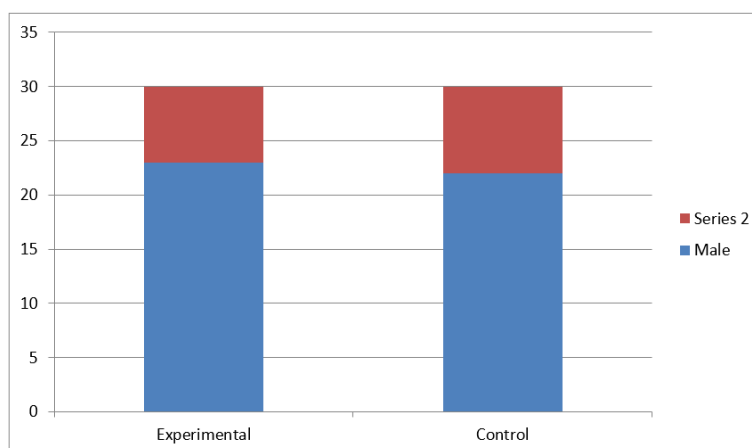
Age	Case	Control
Range	(74-20)	(84-20)
Mean (SD)	57.33 (17.33)	55.73 (17.33)
CI	2.788	2.43
95% Confidence Level	55.68 +/- 5.466	56 +/- 4.77

Table 06: Age distribution among groups

Age	Case	Control
20-30	4	4
31-40	1	1
41-50	5	5
51-60	6	6
61-70	6	6
71-80	7	7
81-90	1	1
Total	30	30

Table 07: Gender distribution among groups

Sex	Case	Control
Male	23	22
Female	7	8
Total	30	30

**Figure 01:** The distribution among genders

In total, there were 76.6% of male and 23.4% of female in both groups. Distribution of cases according to their addresses. There was huge number of cases coming from the capital city Kathmandu with 26.6 % (n=8). Distribution of cases according to their addresses. There was huge number of cases coming from the capital city Kathmandu with 30% (n=9).

Table 08: Baseline and Endline Value of Different Variables in Case and Control Group

Group	n	Time	Day-time frequency	Number of pads	Saturation of pads
Control	30	Pre-treatment	2.03±1.49	1.60±1.35	1.7±1.34
		Post-treatment	1.97±1.49	1.37±1.24	1.5±1.22
		Pre-treatment	2.1±1.93	1.53±1.57	1.53±1.57
Case	30	Post-treatment	0.63±0.80	0.27±0.45	0.43±0.56

Table 09: Nocturnal Incontinence and Liquid Restriction

Group	n	Time	Nocturnal Incontinence	Liquid Restriction	Skin Problems
Control	30	Pre-treatment	1.03±1.18	1.5±0.93	0.57±0.56
		Post-treatment	0.83±0.91	1.4±0.89	0.63±0.61
		Pre-treatment	1.47±1.54	1.5±0.93	0.97±0.96
Case	30	Post-treatment	0.43±0.78	0.73±0.78	0.47±0.50

Table 10: Frequency Of Urge and Urgency

Group	n	Time	Limit Activities	Frequency Of Urge	Urgency
Control	30	Pre-treatment	1.6±1.1	0.93±1.23	0.87±1.38
		Post-treatment	1.47±1.1	0.73±1.04	1.03±1.32
		Pre-treatment	1.67±0.92	1.97±1.09	1.57±1.3
Case	30	Post-treatment	0.87±0.77	0.7±0.65	1.17±0.59

Table 11: Nocturia

Group	n	Time	Nocturia	Longest Interval	Interval without Leak
Control	30	Pre-treatment	2.67±0.88	2.13±0.62	2.57±1.16
		Post-treatment	2.17±1.05	2.0±0.58	2.7±0.83
		Pre-treatment	2.53±1.13	2.47±0.81	2.77±1.27
Case	30	Post-treatment	0.97±0.76	0.97±0.66	1.43±0.93

Table 12: Post-void Fullness

Group	n	Time	Pain	Post-void Fullness	Stream
Control	30	Pre-treatment	1.33±1.02	0.9±1.15	0.7±0.98
		Post-treatment	1.03±0.99	0.93±1.14	0.57±0.85

		Pre-treatment	1.57±1.25	1.5±1.1	1.13±1.10
Case	30	Post-treatment	0.53±0.73	1.1±0.54	1.0±0.45

Table 13: UTI frequency and quality of life

Group	n	Time	Straining	UTI Frequency	Quality of Life
Control	30	Pre-treatment	0.6±1.07	1.13±1.47	3.97±0.18
		Post-treatment	0.6±1.07	0.97±1.32	3.73±0.58
Case	30	Pre-treatment	0.93±1.14	1.0±1.41	3.9±0.4
		Post-treatment	1.27±0.69	0.17±0.46	0.83±0.46

Table 14: Bladder Management Pre& Post treatment Comparison

Group	Time	A (Catheter/bag)	C (CIC)	D (self-voiding)	p value
Case	pre-treatment	17 (56.7%)	4 (13.3%)	9 (30%)	0.11 (pre)
	post-treatment	0 (0%)	2 (6.7%)	28 (93.3%)	
Control	pre-treatment	21 (70%)	0 (0%)	9 (30%)	*0.00 (post)
	post-treatment	16 (53.3%)	2 (6.7%)	12 (40%)	

Table 15: Day Time Frequency Pre& Post treatment Comparison

Group	Time	0 (no leakage)	1 (rarely)	2 (few times a week)	3 (once a day)	4 (>once a day)	p value
Case	pre-treatment	13 (43.3%)	0 (0%)	2 (6.7%)	1 (3.3%)	14 (46.7%)	0.007 (pre)
	post-treatment	17 (56.7%)	7(23.3%)	6 (20%)	0 (0%)	0 (0%)	
Control	pre-treatment	6 (20%)	6 (20%)	7 (23.3%)	4 (10%)	8 (26.7%)	*0.004 (post)
	post-treatment	7 (23.3%)	5(16.7%)	7(23.3%)	4 (13.3%)	7 (23.3%)	

Table 16: Saturation of Pad Pre& Post treatment Comparison

Group	Time	0 (no leakage)	1 (minimal)	2 (one pad)	3 (2 pads)	4 (3 or > pads)	p value
Case	pre-treatment	12 (40%)	4 (13.3%)	6 (20%)	2 (6.7%)	6 (20%)	0.175 (pre)
	post-treatment	18 (60%)	11(36.7%)	1 (3.3%)	0 (%)	0 (0%)	
Control	pre-treatment	6 (20%)	10(33.3%)	5 (16.7%)	5 (16.7%)	4 (13.3%)	0.001 (post)
	post-treatment	8 (26.7%)	7 (23.3%)	9 (30%)	4 (13.3%)	2 (6.7%)	

Table 17: Nocturnal Incontinence Pre & Post treatment Comparison

Group	Time	0 (no leakage)	1 (minimal)	2 (damp)	3 (wet)	4 (soaked)	p value
Case	pre-treatment	13 (43.4%)	3 (10%)	6 (20%)	3 (10%)	5 (16.7%)	0.131 (pre)
	post-treatment	22 (73.3%)	8 (26.7%)	0 (0%)	0 (0%)	----	
Control	pre-treatment	12 (40%)	11(36.7%)	3 (10%)	2 (6.7%)	2 (6.7%)	0.032 (post)
	post-treatment	13 (43.3%)	11(36.7%)	4 (13.3%)	2 (6.7%)	----	

Table 18: Liquid restriction Pre & Post treatment Comparison

Group	Time	0(no leakage)	1(no restriction)	2 (reduce some time)	3 (reduce all time)	p value
Case	pre-treatment	6(20%)	6(20%)	15 (50%)	3 (10%)	0.221 (pre)
	post-treatment	14(46.7%)	10 (33.3%)	6 (20%)	0 (0%)	
Control	pre-treatment	10(16.7%)	18 (30%)	24 (40%)	8 (13.3%)	0.032(post)*
	post-treatment	(16.7%)	11 (36.7%)	11 (36.7%)	3 (10%)	

Table 19: Skin Problems Pre & Post treatment Comparison

Group	Time	0 (no leakage)	1 (no problem)	2 (manage myself)	3 (visit doctor)	p value
Case	pre-treatment	11 (36.7%)	12 (40%)	4 (13.3%)	3 (10%)	0.139 (pre)
	post-treatment	16 (53.3%)	14 (46.7%)	0 (0%)	-----	
Control	pre-treatment	14 (46.7%)	15 (50%)	1 (3.3%)	0 (0%)	0.310(post)
	post-treatment	13 (43.3%)	15 (50%)	2 (6.7%)	-----	

Table 20: Limit activities Pre & Post treatment Comparison

Group	Time	0 (no leakage)	1 (no limit)	2 (some limits)	3 (limits all)	p value
Case	pre-treatment	4 (13.3%)	7 (23.3%)	14 (46.7%)	5 (16.7%)	0.240 (pre)
	post-treatment	11 (36.7%)	12 (40%)	7 (23.3%)	0 (0%)	
Control	pre-treatment	8 (26.7%)	2 (6.7%)	14 (46.7%)	6 (20%)	0.006 (post)
	post-treatment	9 (30%)	3 (10%)	13 (43.3%)	5 (16.7%)	

Table 21: Frequency of UrgePre& Post treatment Comparison

Group	Time	0 (never)	1 (rarely)	2 (few times a day)	3 (many times a day)	p value
Case	pre-treatment	3 (10%)	9 (30%)	3 (13.3%)	14 (46.7%)	0.002 (pre)
	post-treatment	12 (40%)	15 (50%)	3 (10%)	0 (0%)	
Control	pre-treatment	17 (56.7%)	4 (13.3%)	3 (10%)	6 (20%)	0.025 (post)
	post-treatment	18 (60%)	5 (16.7%)	4 (13.3%)	3 (10%)	

Table 22: Urgency Pre& Post treatment Comparison

Group	Time	0 (with catheter)	1 (convenient place)	2 (delay few minutes)	3 (leak)	4	p value
Case	pre-treatment	11 (36.7%)	1 (3.3%)	8 (26.7%)	10 (33.3%)	0 (0%)	0.025 (pre)
	post-treatment	3 (10%)	19 (63.3%)	8 (26.7%)	0 (0%)	0 (0%)	
Control	pre-treatment	20 (66.7%)	2 (6.7%)	2 (6.7%)	4 (13.3%)	2 (6.7%)	0.000 (post)
	post-treatment	17 (56.7%)	2 (6.7%)	5 (16.7%)	5 (16.7%)	1 (3.3%)	

Table 23: Nocturia Pre& Post treatment Comparison

Group	Time	0 (never)	1 (rarely)	2 (once)	3 (twice)	4 (three or >)	p value
Case	pre-treatment	2 (6.7%)	3 (10%)	8 (26.7%)	11 (36.7%)	6 (20%)	0.192 (pre)
	post-treatment	9 (30%)	13 (43.3%)	8 (26.7%)	0 (0%)	0 (0%)	
Control	pre-treatment	0 (0%)	1 (3.3%)	15 (50%)	7 (23.3%)	7 (23.3%)	0.001 (post)
	post-treatment	2 (6.7%)	5 (16.7%)	12 (40%)	8 (26.7%)	3 (10%)	

Table 24: Longest Interval Pre & Post treatment Comparison

Group	Time	0 (>3hrs)	1 (>2hrs)	2 (1-2hrs)	3 (<1hrs)	p value
Case	pre-treatment	4 (13.3%)	10 (33.3%)	14 (46.7%)	2 (6.7%)	0.115 (pre)
	post-treatment	6 (20%)	20 (66.7%)	3 (10%)	0 (0%)	
Control	pre-treatment	4 (13.3%)	18 (60%)	8 (26.7%)	0 (0%)	0.000 (post)
	post-treatment	1 (3.3%)	2 (6.7%)	23 (76.7%)	4 (13.3%)	

Table 25: Interval without leak Pre& Post treatment Comparison

Group	Time	0 (no)	1 (>3hrs)	2 (2-3hrs)	3 (1-2hrs)	4 (<1hrs)	p value
Case	pre-treatment	3 (10%)	1 (3.3%)	7 (23.3%)	8 (26.7%)	11(36.7%)	0.288 (pre)
	post-treatment	6 (20%)	8 (26.7%)	13 (43.3%)	3 (10%)	0 (0%)	
Control	pre-treatment	2 (6.7%)	4 (13.3%)	5 (16.7%)	13 (43.3%)	6 (20%)	0.000 (post)
	post-treatment	0 (0%)	4 (13.3%)	3 (13.3%)	19 (63.3%)	3 (10%)	

Table 26: Pain or discomfort Pre & Post treatment Comparison

Group	Time	0 (never)	1 (rarely)	2 (sometime)	3 (most of time)	4	p value
Case	pre-treatment	8 (26.7%)	7 (23.3%)	6 (20%)	8 (26.7%)	1 (3.3%)	0.182 (pre)
	post-treatment	18 (60%)	8 (26.7%)	4 (13.3%)	0 (0%)	-----	
Control	pre-treatment	9 (30%)	5 (16.7%)	13 (43.3%)	3 (10%)	0 (0%)	0.158 (post)
	post-treatment	12 (40%)	7 (23.3%)	9 (30%)	2 (6.7%)	-----	

Table 27: Post-void fullness Pre& Post treatment Comparison

Group	Time	0 (catheter)	1 (no problem)	2 (sometimes)	3 (most of time)	p value
Case	pre-treatment	7 (23.3%)	8 (26.7%)	8 (26.7%)	7 (23.3%)	0.100 (pre)
	post-treatment	3 (10%)	21 (70%)	6 (20%)	0 (0%)	
Control	pre-treatment	17 (56.7%)	3 (10%)	6 (20%)	4 (13.3%)	0.000 (post)
	post-treatment	16 (53.3%)	4 (13.3%)	6 (20%)	4 (13.3%)	

Table 28: Stream Pre& Post treatment Comparison

Group	Time	0 (catheter)	1 (good stream)	2 (weak)	3 (drips out)	p value
Case	pre-treatment	12 (40%)	6 (20%)	8 (26.7%)	4 (13.3%)	0.449 (pre)
	post-treatment	3 (10%)	24 (80%)	3 (10%)	0 (0%)	
Control	pre-treatment	18 (60%)	5 (16.7%)	5 (16.7%)	2 (6.7%)	0.000 (post)
	post-treatment	16 (53.3%)	7 (23.3%)	5 (16.7%)	2 (6.7%)	

Table 29: Straining Pre& Post treatment Comparison

Group	Time	0 (catheter)	1 (no problem)	2 (sometimes)	3 (most of time)	p value
Case	pre-treatment	16 (53.3%)	4 (13.3%)	6 (20%)	4 (13.3%)	0.236 (pre)
	post-treatment	4 (13.3%)	14 (46.7%)	12 (40%)	0 (0%)	
Control	pre-treatment	21 (70%)	4 (13.3%)	1 (3.3%)	4 (13.3%)	0.000 (post)
	post-treatment	19 (63.3%)	6 (20%)	4 (13.3%)	1 (3.3%)	

Table 30: UTI frequency Pre& Post treatment Comparison

Group	Time	0 (never)	1 (1/year)	2(few times/year)	3(few months)	4 (once month)	p value
Case	pre-treatment	17(56.7%)	5 (16.7%)	2 (6.7%)	3 (10%)	3 (10%)	0.886 (pre)
	post-treatment	26 (86.7%)	3 (10%)	1 (3.3%)	0 (0%)	0 (0%)	
Control	pre-treatment	16 (53.3%)	4 (13.3%)	4 (13.3%)	2 (6.7%)	4(13.3%)	0.066 (post)
	post-treatment	17 (56.7%)	4 (13.3%)	4 (13.3%)	3 (10%)	2 (6.7%)	

Table 31: Quality of Life Pre& Post treatment Comparison

Group	Time	0 (pleased)	1 (satisfied)	2 (mixed)	3 (unsatisfied)	4 (unhappy)	p value
Case	pre-treatment	----	----	1 (3.3%)	1 (3.3%)	28(93.3%)	0.601 (pre)
	post-treatment	6 (20%)	23 (76.7%)	1 (3.3%)	0 (0%)	0 (0%)	
Control	pre-treatment	----	----	0 (0%)	1 (3.3%)	29(96.7%)	0.000 (post)
	post-treatment	0 (0%)	0 (0%)	2 (6.7%)	4 (13.3%)	24 (80%)	

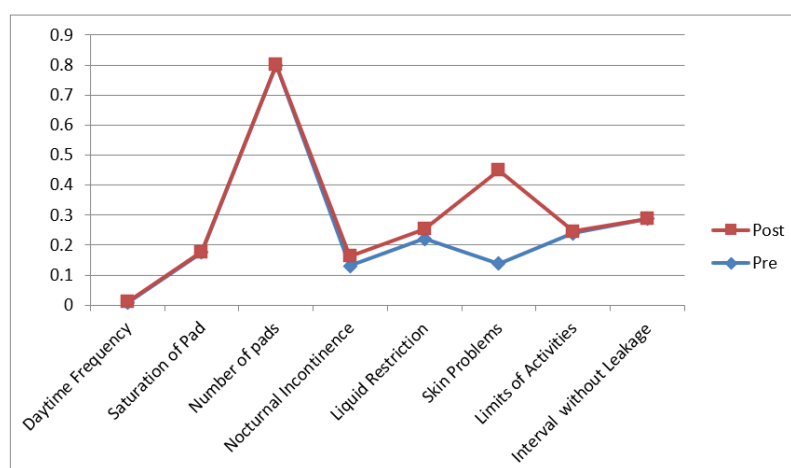


Figure 02: Incontinence

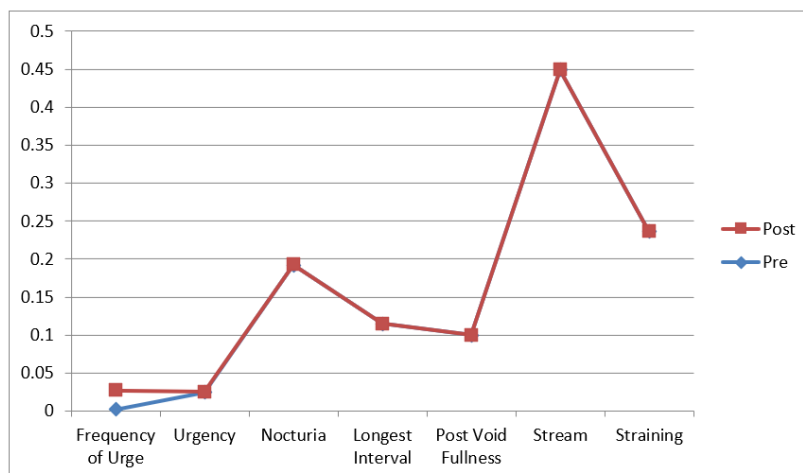


Figure 03: Storage & voiding

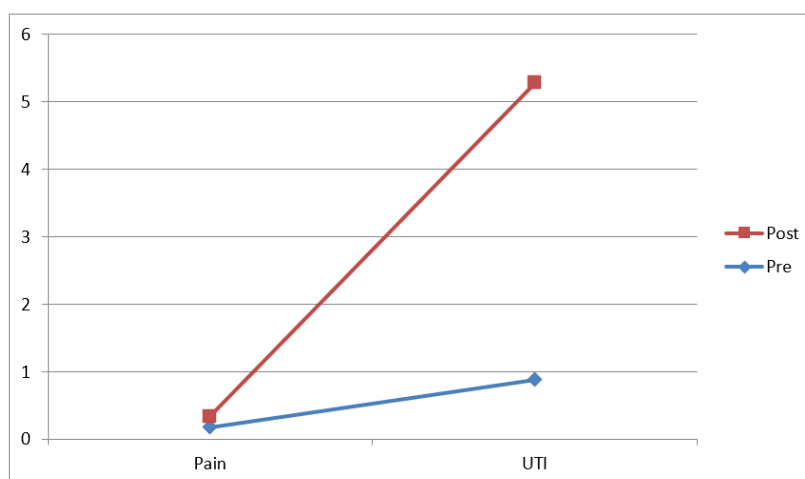


Figure 04: Consequences

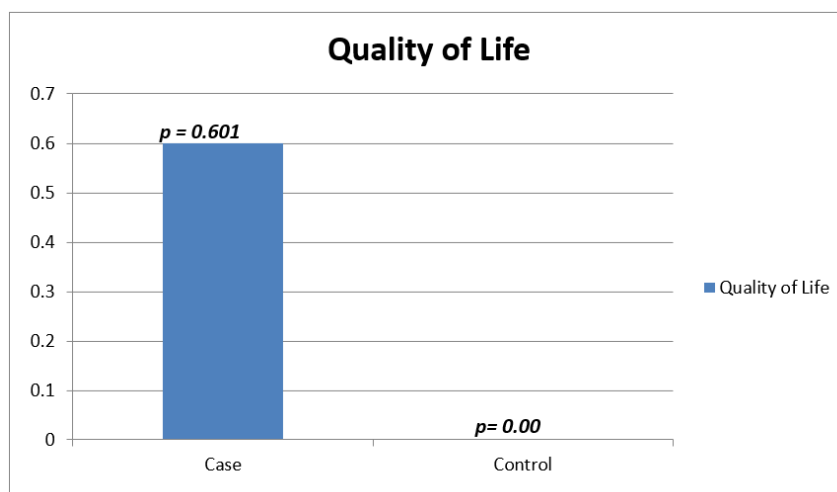


Figure 05: Quality of life

DISCUSSION

NB is one of the most common complications of spinal cord injury and its prevalence is 25% to 85% around the globe [15]. It is associated with both brain and spinal cord injury having symptoms of either overactive or under active bladder [16]. Antimuscarinic agents, Beta-3 adrenergic receptors agonists are commonly used to manage storage problems but these have adverse effects like dry mouth, headache, constipation, dizziness, urinary retention, altered consciousness and cognition alterations, palpitations etc. [17]. Second line treatments like Botulinum toxin and neuromodulation methods are highly effective for managing overactive bladder problems but they are invasive and expensive and require long-term follow up [18]. For voiding dysfunctions intermittent catheterization is the best option. Clean intermittent self-catheterization is preferable to an indwelling catheter, however, if this is not possible, then a supra pubic indwelling catheter is preferable to a urethral catheter for long-term management [19]. Recent study in 2022 showed that there are commonest difficulty among all patients who was practicing CIC in outdoor environments is due to the unavailability of toilet facilities and this study also found urinary tract infection was the most common complication and there was CIC dependence, pain as well as procedural difficulty [20]. Electroacupuncture is the up growing popular forms of intervention, increasingly used in clinical and in experimental research, which is safe and cheap in producing the positive impacts in NB [21]. Regarding my study all subjects demonstrated some positive effect in improving NB's symptoms but the experimental group had better improvements compare to control group. In bladder management group there was significant improvement from catheter to self-voiding by 100% (17 to 0) in experimental group while in control group there was improvement of 17% (21 to 16). There was significant improvement in p-value regarding incontinence management via NBSS score in experimental group compare to control group. The respective p-value in the experimental group in pretest for daytime frequency, saturation of pads, number of pads nocturnal incontinence and liquid restriction, skin problems, limit of activities, interval without leakage were 0.007, 0.175, 0.80, 0.131, 0.221, 0.139, 0.240, and 0.288 respectively. The p-value for same data after post testing were 0.004, 0.002, 0.001, 0.032, 0.032, 0.310, 0.006 and 0.00. This vividly explains that EA had remarkable improvement in incontinence problems in patient with NB. Regarding storage and voiding issue the respective p value for frequency of urge, urgency, nocturia, longest interval, post void fullness, stream and straining were 0.002, 0.025, 0.192, 0.115, 0.100, 0.449, and 0.26. After EA there was notable improvement and its p value pre testing respectively were 0.025, 0.000, 0.001, 0.000, 0.000, 0.000. This further explains that EA can help in improving both storage and voiding symptoms. We had taken only two variables on the consequences group i.e., pain and UTI with their respective value pre testing were 0.182 and 0.886. After EA their posttest values were 0.158 and 0.066 showing significant improvement in consequences of life. About the quality of life in NBSS score there was improvement of p value from 0.601 to 0.000. Hence, this explains integrated therapy of EA combined with conventional management is effective interventions for NB patients compared to conventional management only. The physiological effects of EA can transmit the nerve impulse to the sacral plexus through posterior tibial nerve and produces regulatory effects. Electroacupuncture at four sacral point or Baliao acupoints are also known as electrical stimulation of pudendal nerve. This pudendal nerve neuromodulation and deep needle insertion is commonly used to treat stress incontinence, female urgency, frequency [22]. An author described the effect of manual acupuncture in NB [23]. He further stated that it helps in neuroprotection and regeneration of TrkA and p75NTR which are the main receptors for nerve growth factors promoting growth of axons [24]. Histopathological evaluation showed that manual acupuncture improved muscle fiber alignment disorders and detrusor cell compensatory hypertrophy in bladder tissue. The protein and mRNA expression of NGF, TrkA, p75NTR and level of substance P, CGRP in bladder tissue of the manual acupuncture group were significantly

higher via EA. SP and CGRP subsequently can improve the urine contractility and make better the feeling of bladder fullness in NB while the decrease level of SP and CGRP lead to loss of neurotrophic support and detrusor contraction dysfunctions [25]. An author found that EA in NB Weizhong, Sanyinjiao, Yinlingquan increases the intravesical pressure and content of ATP in urinary bladder tissue. In our study, we took the participants of age 18 or above as they could give consent themselves, and cognition level is higher in this group. In our study mean age of intervention group was 55.68 ± 14.23 years and in control group, it was 56.32 ± 12.03 years. This finding is a little bit different from a study [26], that also shows that 70-84% spinal cord pathology had neurogenic bladder problems. But regarding to cranial cause, the study was done only in stroke but our study showed that beside stroke, brain abscess, DAI, SAH, meningo encephalitis, SDH also had bladder problems. Regarding to stroke ischemic stroke more than hemorrhagic stroke had bladder problems. This is also a noble finding of our study. Minimum age among subjects was 20 whereas maximum age was 84 that suggest neurogenic bladder problems would occur even in younger age this is also a new finding in our study. Our study showed that a huge number of cases coming from the capital city Kathmandu with 26.6 % (n=8) in experimental and 30% in control group. This may be due to the location of hospital, its cost effectiveness, and awareness of medical specialty among participants. In 8th chapter of classical text book *suwen* [27] the urinary bladder is regarded as a reservoir and also as in charge of fluid (urine) storing. According to TCM theory, urinary retention is mainly due to dysfunction of the urinary bladder resulted from dysfunction of qi activities of the triple energizer, or disturbance in qi activity of the urinary bladder resulted from injury of the kidney qi. Zhongji (CV 3) and Guanyuan (CV 4) are regarded as the crossing points of the Conception Vessel and three yin meridians of foot, and Zhongji (CV3) is regarded as the alarm point of the bladder meridian and this is also the Front-Mu point of the Bladder Meridian. When the acupoints like Shuidao, Zhongji, Qihai are used in combination, the bladder function of qi activities can be strengthened, regulated, and the water passage become free. Sanyinjiao, Yinlingquan, Pangguangshu all acupoints help to release damp heat in the urinary bladder. According to TCM theory, damp heat causes anuria, dribbling, hesitancy with scanty urination, burning pain, thirst but there is no desire to drink. Sanyinjiao (SP 6) is also a crossing point of three yin meridians of foot, this point regulates qi of three yin meridians and promote circulation in the lower energizer. Yinlingquan (SP 9) is a Sea point of the Spleen Meridian, it eliminates dampness, clear heat and facilitate water passage. Shuidao (ST28) acupoint when needled from Zhibian to Shuidao using reducing method can radiate the tingling and heaviness sensations to the two lower orifices urethra and anus. Shenshu (BL 23) can be used to stimulate functional activities of vital energy. Spleen and Kidney yang deficiency leads to anuria or dribbling of urination, cold pain and weakness in lower back. Thus, this Shenshu is used to increase the spleen and kidney yang. Pangguangshu (BL 28) is located in the place where meridian-qi transfers. Pangguangshu (BL 28) is used to regulate water passage and facilitate bladder function of qi activities. Ciliao (BL 32) is the crossing point of bladder and gallbladder meridian. It can regulate water passage and benefit the bladder. It is the main point for acupuncture anesthesia in the lower abdomen, thus it regulates water passage and help to relief pain during micturition. Acupuncture and moxibustion can improve the ureter micro-circulation in the injured area. It improves cell regeneration, helps in metabolism, and promotes fast recovery. According to traditional Chinese medicine, neurogenic bladder after spinal cord injury can be classified as longbi or urosis and weibing or flaccidity. An author [28] recorded that pricking of baliao is used for urination problems while zhongliao and xialiao acupoints is used for urine as well as stool problems. An author [20-12] says, deep pricking is needed for qi sufficient. Thus deep needling of Baliao acupoint can promote qi to the diseased area, increase the blood circulation, nourishes yin and yang, facilitate the passage of orifices and the urination. Deep needling of Baliao acupoint compared to conventional acupuncture is found to be more effective as it can better stimulate the sacral nerve through the sympathetic and parasympathetic neural reflex, coordinates the detrusor muscles, urethral sphincter and pelvic floor muscles, reduce urethral obstruction and improve the urine storage and

voiding ability. Baihui百会 (GV20) is one of the most important acupoint of Governor vessel or Du meridian. In Chinese medicine it is regarded as the meeting point of all yang meridians and research showed that it is responsible for enhancing nitric oxide (NO) generation and increasing blood circulation [22,24]. This point has a stimulating effect on CNS in both Brain and Spinal cord and help to release neurotransmitters or neuromodulation into brain and spinal cord thus helps to influence the self-regulatory system of body. Study conducted showed that GV20 is located in the area of frontal lobe anterior precentral sulcus. In human beings' sense of bladder fullness and micturition is initiated by micturition centers in frontal lobe that activate the detrusor reflex which is mediated by pontine micturition center. Thus, lesions of the medial frontal micturition center can result in the activation of the pontine and spinal micturition centers when the bladder is full, causing urinary incontinence [29]. Thus, acupuncture in Baihui百会 acupoint helps to regulate the frontal lobe and its functions.

4. CONCLUSIONS

The effects of EA on management of NB were measured via NBSS score in neurologically affected population and compared with conventional management (allopathic medicine). The result of the present study suggests that 30 minutes of EA on Ciliao (BL23) and Shuidao (ST28) and acupuncture in other acupoints like Sanyinjiao (SP6), Yinlingquan (SP9), Qugu (CV2), Zhongji (CV3), Qihai (CV6), Shenshu (BL23), Pangguanshu (BL28), Baihui (GV20), Zhaohai (KL6), Zhongliao (BL33), Xialiao (BL34), Guanyuanshu (BL26) along with conventional managements is very effective in improving symptoms of both overactive and under active bladder issues. Evidence suggests that EA is the vital components in treating NB issues so it should be taken into considerations while treating NB problems. Hence, this study led to the conclusion that integrated therapy of EA combined with conventional management is effective intervention for NB patients compared to conventional managements only.

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