Clinical Communication

Effect of decompressive cervical spine surgery on hypertension in patients with cervical spondylotic myelopathy - A retrospective observational study

INTRODUCTION

Significant cervical spinal cord compression due to degenerative changes associated with ageing in the cervical spine is termed cervical spondylotic myelopathy (CSM).[1] The disease slowly progresses and patients may have motor weakness, gait ataxia, stiffness of all four limbs and variable sensory loss with or without bowel and bladder incontinence.[2] Decompressive cervical spine surgery is advised for patients who have progressive CSM with worsening symptoms and those who do not improve with conservative management.[3] In patients who undergo cervical decompressive surgery for CSM, significant haemodynamic fluctuations have been reported due to various reasons like autonomic dysfunction and cervical cord compression.[4] Our study aimed to find out the incidence of hypertension in patients undergoing surgery for CSM and its status after decompressive spine surgery for CSM.

METHODS

This retrospective study analysed data of 78 patients who underwent cervical decompressive surgery for CSM between January 2018 and February 2020. Before the commencement of the study, approval was obtained from the institutional ethics committee (ECR/782/Inst/MH/2015/RR-18). The study was registered in the clinical trial registry (CTRI/2021/01/030741). Patients who underwent cervical decompressive surgery either by anterior approach or by posterior approach for symptomatic CSM and who completed follow-up till one year were included in the study. Patients having cervical spinal cord compression due to other causes like trauma, infection and neoplasms and who did not complete the follow-up at the end of one year were excluded from the study.

The data were collected from medical records and outpatient department (OPD) medical records, both electronic and patient files that included pre-operative and post-operative parameters. Pre-operative parameters collected were demographic characteristics like age and sex, coexisting medical diseases including hypertension, details of antihypertensive medications (AHMs), surgical approaches and blood pressure (BP) recordings.

Post-operative parameters obtained were post-operative BP records on day one and day seven, follow-up BP records at one, three, six months and one year in OPD and status of AHM continued/continued in reduced doses/discontinued.

Data were summarised by frequency and percentage for categorical variables, mean and standard deviations for continuous variables. Data were tested for normality by using Kolmogorov–Smirnov test and it was non-normally distributed. Friedman test was used to assess the changes in systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) over a period of time followed by a post hoc analysis using the Wilcoxon signed-rank test conducted with a Bonferroni correction. A *P* value less than 0.05 was considered significant. Data analysis was performed by using the International Business Machines Statistical Package for the Social Sciences (IBM SPSS, Chicago, IL, USA) software version 20.0.

RESULTS

Out of the 78 patients included in the analysis [Figure 1], the majority of the patients were males. Four patients had coexisting medical illnesses like bronchial asthma, hypothyroidism, ischaemic heart disease and cerebrovascular accident. Twenty-three patients were known cases of hypertension and were taking AHM before admission. Nine patients were started on AHM when they were admitted to the hospital for decompressive cervical spine surgery (Group I). Out of the 23 patients taking AHM, 13 patients were started on AHM within the last six months (Group II). Ten patients were taking AHM for a duration of more than six months (Group III).

All the patients received general anaesthesia with a similar technique of induction and intraoperative management. All the patients were shifted to the neurosurgical intensive care unit (NICU) for one day.

Thus, 32 patients (41.02%) out of a total of 78 patients in our study were found to be hypertensive before surgery. Forty-six patients (58.98%) were normotensive.

In group I, group II and also in group III patients, there was a statistically significant difference in SBP, DBP and MAP [Table 1].

There was a statistically significant reduction in SBP, DBP and MAP between the pre-operative and post-operative day one and day seven values in group I and group II patients. But there was no statistically significant reduction in SBP, DBP and MAP between the pre-operative and post-operative day one and day seven values on post hoc analysis in group III [Table 2].

In group I and group II patients with a duration of hypertension of less than six months, AHMs were discontinued in 8 (88.88%) and 10 (76.92%) patients, respectively, at the time of discharge. None of these patients needed resumption of AHM till the time of discharge. The remaining one patient (11.22%) in group I and three patients (23.08%) in group II who needed continuation of AHM showed well-controlled BP and did not need any additional drugs till they were discharged from the hospital. In group III patients, AHMs that the patients were taking before the surgery were continued in all the 10 (100%) patients. However, in two patients, the dose of AHM was reduced at the time of discharge.

Table 1: Group I, II, III data, pre-operative and post-operative hypertensive status

BP (mmHg)	Mean±SD	χ^2	*P*
Group I data: Pre-operative and post-operative hypertensive status			
Pre-operative SBP	154.4±7.3	17.18	<0.0001
Post-operative day 1 SBP	132.2±14.8		
Post-operative day 7 SBP	116.7±10		
Pre-operative DBP	100±0	15.75	<0.0001
Post-operative day 1 DBP	81.1±7.8		
Post-operative day 7 DBP	75.6±5.3		
Pre-operative MAP	117.9±2.7	15.94	<0.0001
Post-operative day 1 MAP	97.1±10.4		
Post-operative day 7 MAP	89±5.4		
Group II data: Pre-operative and post-operative hypertensive status			
Pre-operative SBP	160±10.4	22.14	<0.0001
Post-operative day 1 SBP	135.8±13.8		
Post-operative day 7 SBP	121.7±8.3		
Pre-operative DBP	100.5±5.3	21.27	<0.0001
Post-operative day 1 DBP	82.5±7.5		
Post-operative day 7 DBP	76.7±7.8		
Pre-operative MAP	120.7±5.1	21.56	<0.0001
Post-operative day 1 MAP	100.7±7.7		
Post-operative day 7 MAP	91.5±7.6		
Group III data: Pre-operative and post-operative hypertensive status			
Pre-operative SBP	151.0±11.0	9.15	0.01
Post-operative day 1 SBP	140.0±10.5		
Post-operative day 7 SBP	138.0±12.3		
Pre-operative DBP	91.6±7.5	7.65	0.02
Post-operative day 1 DBP	85.6±5.0		
Post-operative day 7 DBP	82.6±4.3		
Pre-operative MAP	110.9±7.2	6.53	0.038
Post-operative day 1 MAP	104.1±5.3		
Post-operative day 7 MAP	100.3±7.0		

χ^2 – Friedman test value; SBP – Systolic blood pressure; DBP – Diastolic blood pressure; MAP – Mean arterial pressure; SD – Standard deviation; BP – Blood pressure

Normotensive patients did not show any fluctuations in the BP in the post-operative period and at follow-up.

All the patients in our study attended follow-up at one, three, six and twelve months following surgery. From the medical records, it was seen that none of the patients belonging to groups I and II whose AHM were discontinued at the time of discharge needed to restart AHM. In group III patients, the blood pressure was well controlled in all the patients at all follow-up visits. All these patients showed good control of BP at all the follow-up visits and none of them required any additional AHM.

DISCUSSION

The association between CSM and hypertension was first published in 2012 by Hong Liu *et al*.[5] This study reported high BP in 35 patients with CSM. Cervical decompressive surgery resulted in normotension in 15 (42.86%) patients with discontinuation of AHM. In another 12 (34.28%) patients, cervical decompression helped in stabilising the high BP with good control by AHM.

In our retrospective observational study, it was found that 32/78 (41.02%) patients who had CSM also suffered from hypertension.

These findings are also similar to the study published by Zequn Li *et al*.[6] where they found an association between CSM and hypertension in 46. 6% cases. They developed the new terminology 'CSM associated hypertension' due to the increase in the prevalence of hypertension in patients with CSM.

The pathophysiological role of the sympathetic nervous system (SNS) in the genesis of hypertension is very well established.[7] Due to significant spinal cord compression in CSM, there occurs chronic irritation of the dura mater of the cervical spinal cord and the posterior longitudinal ligament (PLL).[8] It is well known that the cervical disc, dura mater and PLL are rich in

Table 2: Post hoc analysis data, pre-operative and post-operative hypertensive status

	SBP 1	SBP 2	DBP 1	DBP 2	MAP 1	MAP 2
Group 1						
Z	- 2.69	-2.69	-2.70	-2.74	-2.68	-2.67
P	0.007	0.007	0.007	0.007	0.007	0.008
Reduction	22.2±13.01	37.8±9.72	18.89±7.82	24.44±5.27	20.78±9.47	28.89±6.05
Group 2						
Z	-2.95	-3.09	-3.13	-3.09	-3.06	-3.07
P	0.003	0.002	0.002	0.002	0.002	0.002
Reduction	24.17±16.21	38.33±11.93	18.00±5.78	23.83±9.63	20.00±6.61	29.17±9.18
Group 3						
Z	-2.49	-2.23	-1.56	-2.41	-1.79	-2.39
P	0.013	0.026	0.12	0.02	0.07	0.017
Reduction	11.0±8.75	13±16.37	6.00±11.11	9.00±7.00	6.80±9.75	10.60±9.53

Post hoc analysis with Wilcoxon signed-rank test with applied Bonferroni correction resulted in a significant level set at $P<0.017$ for all 3 variables SBP, DBP, MAP in all the 3 groups. SBP 1 – Systolic blood pressure value on post-operative day 1; SBP 2 – Systolic blood pressure value on post-operative day 7; DBP 1 – Diastolic blood pressure value on post-operative day 1; DBP 7 – Diastolic blood pressure value on post-operative day 7; MAP 1 – Mean arterial pressure on day 1; MAP 2 – Mean arterial pressure on day 7

sympathetic fibres. It seems likely that stimulation of sympathetic nerve fibres in the pathologically degenerative disc and surrounding tissue produces sympathetic excitation and induces sympathetic reflex. Surgical decompression of the cervical spine in CSM will relieve the chronic sympathetic irritation and may decrease BP.

Itoki *et al*.[9] reported 46/68 (67.65%) CSM patients who showed significant blood pressure reduction six months after they underwent laminoplasty.[9] Our findings were similar as 32/78 (41.02%) patients were detected hypertensive and AHMs were stopped in 18/32 (56.25%) patients after cervical decompressive surgery. While in another 43.75% of patients (14/32), though we continued AHM, the BP was more stabilised and in 2 patients amongst these 14 patients, the number of AHM was reduced at the time of discharge with stable BP on follow-up at one, three, six months and one year.

The most interesting finding of our study was that AHMs were discontinued in 8/9 (81.82%) patients belonging to group I and 10/13 (76.92%) in group II. Normal 2D echocardiographic findings in all 18 patients in whom AHMs were discontinued suggested the recent onset of CSM-associated hypertension. The fact that we could discontinue AHM in a majority of these patients suggests the possibility of secondary hypertension due to CSM.

The limitations of our study are the small sample size and the retrospective nature. A prospective study may give better evidence with better elimination of bias. We did not consider chronic neck pain as a risk factor for hypertension and have followed up with patients only for one year. Multicentre studies with longer follow-ups may be needed to show whether the recent onset of hypertension in CSM is really a cause of secondary hypertension.

CONCLUSION

We observed that decompressive cervical spine surgery for CSM resulted in the amelioration of hypertension in recently detected (less than six months duration) hypertensive patients. However, in patients with a longer duration of hypertension (more than six months duration), the surgical intervention did not cause resolution of hypertension.

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Conflicts of interest
There are no conflicts of interest.

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