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RESEARCH ARTICLE

NUTCRACKER SYNDROME AS CAUSE OF VARICOCELE AND ITS RELATION WITH BMI

[1]Dr. Sartaj Hassan Shah, [2]Dr. Shabir Ahmad Bhat and [3]Dr. Najeeb Talal

[1]Registrar Deptt Radiodiagnosis, Govt Medical College Srinagar
[2]Associate Professor, Govt Medical College Srinagar
[3]Resgistrar Deptt Radiodiagnosis GMC Sgr

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ABSTRACT

Aim: In this study, we evaluated the incidence of nutcracker syndrome as a cause of varicocele in young adults and its relation with body mass index (BMI). **Materials and Methods:** This prospective study included a total of 30 patients who were referred for high resolution (HR) ultrasound examination of scrotum for evaluation of varicocele. Upper abdominal ultrasonography (USG) and Doppler was done in all cases for assessment of renal vein hilar and superior mesenteric artery (SMA) segment transverse diameter, peak velocities in hilar and superior mesenteric artery (SMA) segments of renal vein. **Results:** In our study we found Nutcracker phenomenon to be a cause of varicocele in 13.33% of cases of varicocele. We also observed that it was more common in cases with low body mass index (BMI) and higher grades of varicocle. **Conclusion:** Upper abdominal scan for assessment of status of renal vein should be routinely done in all cases of varicocele, particularly in cases with higher grades of varicocele and low body mass index (BMI)

Corresponding author

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INTRODUCTION

Nutcracker phenomenon is also known as renal vein entrapment syndrome (Cope, 1969; Barnes *et al*., 1988; Rudloff *et al*., 2006). It is characterised by impeded left renal vein outflow due to its extrinsic compression most commonly between aorta and superior mesenteric artery (SMA) resulting in its lateral/hilar dilatation and collateral formation. nutcracker syndrome is clinical equalent of nutcracker phenomenon characterised by variable symptoms, including haematuria, pain, gonadal vein syndrome (Coolsaet, 1978), varicocele (Chait *et al*., 1971; Wendel, 1980; Coolsaet, 1978; Park *et al*., 2004) orthostatic proteinuria (Takahashi, 2000; Devarajan, 1993; Ekim *et al*., 1999; Ekim, 2006; Ha, 2006; Ha, 2007; Lee *et al*., 1997; Park *et al*., 2002; Shin, 2007; Shintaku, 1990) and orthostatic intolerance (Takahashi *et al*., 2005; Dever, 1986), chronic fatigue syndrome and pelvic congestion syndrome. Haematuria is most commonly reported symptom and is attributed to rupture of thin walled Varices by elevated venous pressure (Beinart *et al*., 1982; Beckmann, 1982; Stewart, 1982).

It may be microscopic or macroscopic. Diagnosis of syndrome is difficult and is often delayed. Earlier studies have predominantly evaluated its role in haematuria; purpose of our study was to evaluate its role in varicocele and its relation with (body mass index) BMI in young adults.

MATERIALS AND METHODS

This was a prospective study which included a total no of 30 young adult male patients in age range of 19-41 years with clinical evidence of varicocele. Only 2 patients had complains of haematuria. Grey scale ultrasound examination of scrotum was done followed by Doppler evaluation to look for grade of varicocele. All patients were examined in spine and standing position. This was followed by assessment of anteroposterior (AP) diameter of renal vein in its superior mesenteric artery (SMA) segment (where it crosses between SMA and aorta) and renal hilar segment, followed by measurement of peak velocities in same segments in supine position. Doppler angle was kept below 60 degrees.

Sample volume was kept 2-4 mm in hilar segment and 6-8 mm in superior mesenteric artery (SMA) segments to compensate for movement due to pulsations. All patients were examined GE S8 ultrasound machine using 13Mhz linear probe for scrotal scanning and 5mhz probe for renal vein assessment. Criteria used to define/label a case as nutcracker syndrome included hilar-SMA segment renal vein diameter ratio of >5 and SMA –hilar segment peak velocity ratio of >5. A written and informed consent was obtained from the patients for the purpose of this study. This study was approved by the institutional ethics committee.

RESULTS

Out of 30 patients with varicocele, 4 (13.33%) had evidence of nutcracker syndrome. Hilar-SMA segment renal vein diameter ratio was in range of 1.85 to 5.69, and the mean diameter ratio was 3.06. Similarly, the SMA–hilar segment Peak velocity ratio range was 1.83 to 8.12 and the mean ratio was 2.51. The mean peak velocity in SMA was 48.73 cm/s (40.4 – 150.2) and that in pre SMA was 25.27 cm/s (11.4 – 27.6). Grade of varicocele was higher in cases with evidence of nutcracker syndrome (NCS) than in others.

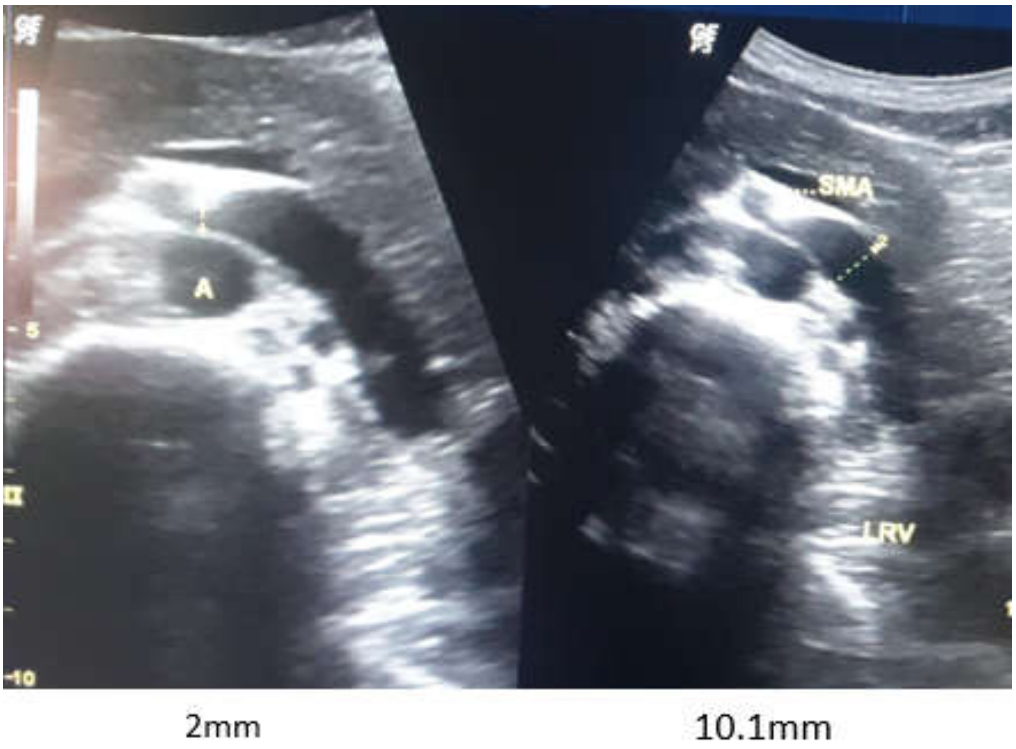

Figure 1. SMA segment and pre SMA segment renal vein diameter in case of nutcracker syndrome

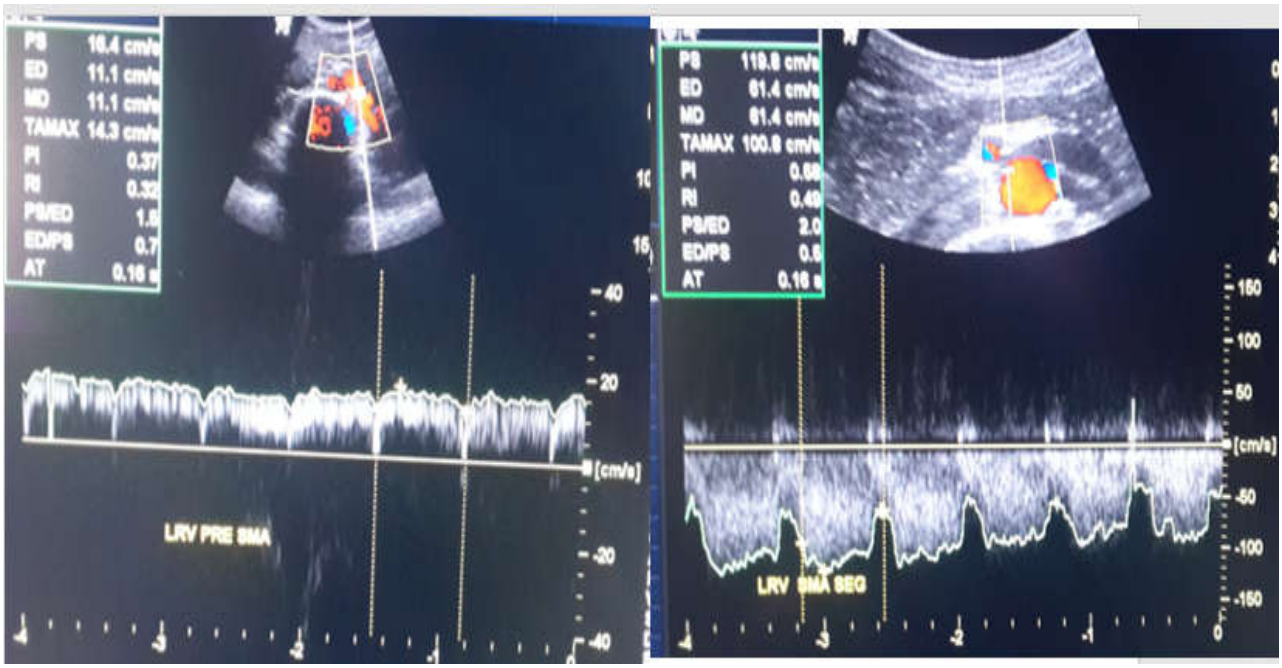

Figure 2. Spectral Doppler of renal vein in pre SMA and SMA segments in a case of nutcracker syndrome

PT	AGE IN YEARS	VARICOCELE GRADE	BMI	HILAR RV APDIA (mm)	SMA seg RV AP DIA(mm)	DIAMETRE RATIO	SMA PV (cm/sec)	PRE SMA PV (cm/sec)	PV RATIO
1	19	V	16.2	10.1	2.0	5.05	140.2	25.5	5.498039216
2	23	IV	17.1	8.7	1.6	5.43	117.8	14.5	8.124137931
3	25	IV	16.4	13.1	2.3	5.69	150.2	27.6	5.442028986
4	22	V	16.8	12.5	2.5	5	65.3	11.4	5.728070175
5	32	III	22	6.3	3.4	1.85	40.4	22.0	1.836363636
6	35	III	21	7.5	4.0	1.87	35.3	204	0.173039216
7	28	III	19.4	6.6	3.3	2	24.6	15.2	1.618421053
8	24	IV	19.7	9.1	3.5	2.6	35.8	20.1	1.781094527
9	23	III	26	5.8	2.8	2.07	23.5	15.9	1.477987421
10	38	II	25.5	7.5	3.0	2.5	50.2	21.3	2.356807512
11	33	III	19.8	6.8	1.9	3.57	42.6	24.6	1.731707317
12	27	IV	24.1	7.8	3.2	2.43	38.7	20.0	1.935
13	20	III	23.2	6.5	3.2	2.03	48.1	25.2	1.908730159
14	30	III	24.5	9.0	3.3	2.72	38.5	18.2	2.115384615
15	26	IV	19.8	7.2	1.8	4	3.36	15.4	0.218181818
16	22	III	31	7.5	1.9	3.94	24.2	13.8	1.753623188
17	33	II	25.1	8.2	3.7	2.21	32.6	12.6	2.587301587
18	31	I	18.8	8.5	2.9	2.93	23.4	15.2	1.539473684
19	21	III	18.6	7.9	2.6	3.03	50.6	21.7	2.331797235
20	24	II	20.1	6.3	1.8	3.5	46.8	25.2	1.857142857
21	22	II	21.5	6.7	3.4	1.97	41.4	22.3	1.856502242
22	35	III	23.8	7.2	3.1	2.32	47.1	26.2	1.797709924
23	26	II	32.2	6.6	2.3	2.86	52.6	23.4	2.247863248
24	25	III	20.5	8.8	3.1	2.83	55.2	17.1	3.228070175
25	31	IV	21.7	5.8	2.8	2.07	32.1	13.4	2.395522388
26	22	II	22.9	7.3	2.6	2.80	48.3	21.2	2.278301887
27	30	IV	25.2	6.7	1.8	3.72	42.6	14.7	2.897959184
28	24	III	17.3	7.6	2.7	2.81	32.9	17.2	1.912790698
29	27	II	21.1	6.5	2.1	3.09	43.3	19.5	2.220512821
30	23	II	18.9	8.4	2.9	2.89	34.3	13.7	2.503649635

DISCUSSION

The basic mechanism of nutcracker syndrome is compression of left renal vein between superior mesenteric artery (SMA) and aorta. Most common symptom of nutcracker syndrome is haematuria, caused by venous hypertension resulting in rupture of small venous collaterals into calyceal fornices (Beinart *et al*., 1982; Beckmann, 1982; Stewart, 1982; Zerin, 1991; Gittes, 1981; Abuelo, 1983; Buschi, 1980; Sayfan *et al*., 1984; Hayashi, 1980; Stewart, 1982; Nishimura, 1986; Beinart *et al*., 1982). Patients may have flank pain also. Venous collaterals of varying severity have been demonstrated in earlier study angiographically (Seung *et al*., 1996). Woulfish etal reported than ultrasound evidence of severe compression of left renal vein (LRV) between superior mesenteric artery (SMA) and aorta along with presence of 90% isomorphic red cells in urine is sufficient evidence to confirm presence of nutcarker syndrome in patients with haematuria (Wolfish, 1986). Varicoceles almost always occur on the left side and affect up to 9.5% of men. It is believed to be caused by reflux into gonadal vein resulting in its dilatation causing varicocele or ovarian vein syndrome (Barnes *et al*., 1998; Zerhouni *et al*., 1980; Kim *et al*., 1992). Opacification of internal spermatic vein on left renal venography was found in 58 % of cases in an earlier study (Seung *et al*., 1996, however reported incidence of varicocele in cases of nutcracker syndrome has been low in this study. We observed a relatively higher incidence of nutcracker syndrome in cases of varicocele in our study.

Considering the frequency of spermatic vein valve absence or incompetency, Zerhouni *et al*. (1980) also contend that this finding is irrelevant and that left renal vein (LRV) hypertension is the usual cause of varicoceles. The left renal vein (LRV) was compressed in 50% to 100% of all patients with varicocele (Chait *et al*., 1971; Unlu *et al*., 2007) although not all patients with varicocele have a distended left renal vein (LRV) (Buschi, 1980; Park *et al*., 2004). We also found in our study that nutcracker phenomenon (NCP) is associated with low body mass index (BMI). Lower body mass index (BMI) has been show to correlate positively with nutcracker phenomenon (NCP) (Shaper *et al*., 1994; Shin *et al*., 2007) and nutcracker phenomenon (NCP) may manifest after weight loss[42]although many individuals with relatively low body mass index (BMI) and aortomesenteric angles have no signs of nutcracker phenomenon(NCP) (Fitoz *et al*., 2007)

Conclusion

Nutcracker syndrome is a cause of high grade varicocele and is associated with latter in absence of haematuria also. routine upper abdominal screening for assessment of renal vein diameter and its peak velocity (PV) should be done in all young adults with varicocele especially in ones with high grade of varicocele. High grade varicoceles should raise suspicion for the diagnosis.

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