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Original Article

Comparative Study of the Clinical Profile and Imaging Features of Neurocysticercosis and Challenging Central Nervous System Tuberculomas

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Abstract

Background and Objective: Neurocysticercosis (NCC) is a common parasitic disease in the central nervous system (CNS). In India and other less developed countries, the diagnosis of NCC is frequently difficult because several other prevalent disorders can present with similar clinical and neuroimaging pictures. These imaging features are shared by infective conditions such as tuberculoma, fungal granuloma, neoplastic condition such as cerebral metastasis and toxoplasma, and CNS lymphoma in HIV-positive patients.

Materials and Methods: This is a prospective and retrospective study with indoor patients of a tertiary care center. The duration of the study was for 18 months. The sample size is 20 cases of NCC and 20 cases of CNS tuberculoma (who pose a diagnostic dilemma.

Results: In the present study, 36 indoor patients from the general medicine ward were included in the study. Among 36 patients, 21 were diagnosed as NCC and 15 as CNS tuberculoma. Rest based on various parameters, the results are depicted in tables.

Conclusion: NCC is the most common parasitic infection of the brain caused by *Taenia solium*. NCC is one of the most common leading causes of seizures in India. Disease is more common in people with non-vegetarian diet but vegans also may get infected through the fecal-oral route. A scenario in which a patient presents with a ring-enhancing lesion if posing a diagnostic dilemma between NCC and tuberculoma must be resolved to avoid antitubercular treatment in cases of NCC.

Key words: Central nervous system, Disease, Neurocysticercosis

INTRODUCTION

Neurocysticercosis (NCC) is a common parasitic disease in the central nervous system (CNS). It is caused by *Taenia solium* and its most common presentation is seizure. Less common presentations are intracranial hypertension (ICH), brainstem dysfunction, cerebellar ataxia, sensory deficits, involuntary movements, stroke-like symptoms, extrapyramidal signs, dementia, Bruns syndrome, Kluver-Bucy syndrome, and cortical blindness.[1]

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The overwhelming majority of patients with NCC have either single-enhancing or less frequently multiple-enhancing CT lesions. The locations of these lesions may vary from the cerebrum to the cerebellum or the spinal cord, where the consequences of raised intracranial tension may be disastrous.

In India and other less developed countries, the diagnosis of NCC is frequently difficult because several other prevalent disorders can present with similar clinical and neuroimaging pictures. These imaging features are shared by infective conditions such as tuberculoma, fungal granuloma, neoplastic conditions such as cerebral metastasis and toxoplasma, and CNS lymphoma in HIV-positive patients.[2]

Out of all these differentials, the most important is tuberculomas. Tuberculosis (TB) is extremely common

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in our country and CNS tuberculoma is an important extrapulmonary manifestation of TB. Both NCC and tuberculomas are important causes of RELs in the CNS and as the management is completely different, they need to be differentiated.

The imaging features of tuberculoma are exceedingly similar to that of NCC and it is difficult to differentiate between these two conditions. Due to their high prevalence, there could also be a fortuitous presence of both these disorders in the same patient. This distinction is an important issue because single cysticercus granuloma is benign and a self-limiting condition, whereas tuberculoma is an active infection that requires prolonged therapy with potentially toxic drugs.[3]

Routine imaging modalities like CT brain may be unable to differentiate between the two conditions and superior techniques such as MRI or MR spectroscopy may have to be resorted to.

If the patient has a clinical history compatible with TB or evidence of TB elsewhere in the body, like chest radiograph or lymphadenopathy on USG abdomen, this can be taken as corroborative evidence of tuberculoma. However, in the absence of these, it is very difficult to distinguish between tuberculomas and NCC.

Second, there are four main stages of NCC, namely, vesicular, colloidal, granular, and calcified. All these stages may not need treatment with scolicidal drugs and antiedema measures.

Some stages may need only antiepileptic drugs. Hence, it is important to

1. Distinguish between NCC and CNS tuberculoma.
2. To diagnose the stage of NCC on imaging.

MATERIALS AND METHODS

Study Design

This was a prospective and retrospective study.

Population

Indoor patients of a tertiary care center.

Duration of Study

The study period was 18 months.

Sample Size

The sample size was 20 cases of NCC and 20 cases of CNS tuberculoma (who pose a diagnostic dilemma).

(Minimum number of cases required for this study is 11 per group).

Inclusion Criteria

The following criteria were included in the study:

1. Age more than 18 years
2. IPD patients only
3. Suspected patients of NCC
4. Patients of suspected CNS tuberculomas

(With no evidence TB elsewhere in the body that do not have constitutional symptoms suggestive of TB)

Exclusion criteria: The following criteria were excluded from the study:

1. Age <18 years
2. Patients who have constitutional symptoms and ring-enhancing lesions strongly suggestive of tuberculomas with/without TB elsewhere in the body.
3. Pregnant patients (as CT cannot be done in pregnant patients).
4. HIV-positive patients.
5. Known case of seizure disorder.

Method of Data Collection

Institutional Ethics Committee approval was obtained. Thirty-six indoor patients were enrolled in the study after a written informed consent. Immunocompetent, adult patients who fulfil the inclusion criteria were included in the general medical wards. Immunocompetent adult patients who present with seizures and/or focal neurological deficit were to be subjected to CT Brain.

These patients in whom the CT brain shows ring-enhancing lesions (single or multiple), where the diagnosis is not clear cut, and there is a possibility of NCC versus tuberculoma were included (if there is no history of constitutional symptoms and/or evidence of TB elsewhere in the body).

These patients were further subjected to MRI brain and if necessary to MR spectroscopy. Decision regarding treatment options such as anticonvulsants and antiedema measures were taken only after imaging studies (CT/MRI). Then, stage of NCC was then taken into consideration and according to the stage of NCC, the decision regarding scolicidal drugs was taken.

RESULTS

In the present study, 36 indoor patients from the general medicine ward were included in the study.

Among 36 patients, 21 were diagnosed as NCC and 15 as CNS tuberculoma.

Thirteen out of 21 patients of NCC and seven out of 15 patients of CNS tuberculoma belong to the age

group of 18–25 years. Four patients of NCC and five patients of CNS tuberculoma belong to the age group of 26–40 years. Four patients of NCC and three patients of CNS tuberculoma belong to the age group of more than 40 years. There is no significant variation in the age-wise distribution of NCC and CNS tuberculoma ($P = 0.582$).

Out of 21 patients of NCC, 16 (76.2%) were male and 5 (23.8%) were females whereas out of 15 patients of CNS tuberculomas, 8 (53.3%) were male and 7 (46.7%) were female.

There is no significant variation in gender-wise distribution of NCC and CNS tuberculoma ($P = 0.6509$).

Among 21 patients of NCC, 16 presented with seizure as a main presenting symptom while two presented with headache, one presented with altered sensorium, one presented with hemiparesis, and one with outward deviation of the eye.

Among 15 patients of CNS tuberculoma, six patients presented with altered sensorium, five with seizure, three with headache, and one with hemiparesis.

There is significant variation in the clinical features of NCC and CNS tuberculomas ($P = 0.044$).

Out of 21 patients of NCC, none of the patients had constitutional symptoms of TB whereas five out of 15 patients of CNS tuberculomas had a history of constitutional symptoms.

Hence, there is significant variation in the constitutional symptoms of TB among NCC and CNS tuberculomas ($P = 0.004$).

Among 21 patients of NCC, one patient presents with papilledema whereas three out of 15 patients of CNS tuberculoma present with papilledema.

Hence, there is no significant variation in the presence of papilledema on fundoscopy in NCC and CNS tuberculomas ($P = 0.151$).

In the treatment of NCC and CNS tuberculoma, 16 out of 21 patients of NCC and 13 out of 15 patients of CNS tuberculoma were given antiedema measures.

There is no significant variation in the use of antiedema measures in the treatment of both NCC and tuberculoma ($P = 0.434$).

Nineteen out of 21 patients of NCC required anticonvulsant therapy either therapeutically or prophylactically whereas 13 out of 15 patients of tuberculoma required antiepileptics. There is no significant variation in the use of antiepileptics for NCC or tuberculoma ($P = 0.720$).

Among 21 patients of NCC, 17 were given scolicidal drugs whereas none of the tuberculoma patients were given scolicidal drugs.

There is significant variation in the use of scolicidal drugs in NCC and Tuberculoma.

Among 21 patients of NCC, one patient was given ATT whereas all patients of CNS tuberculoma were given antitubercular treatment.

There is significant variation in the use of antitubercular drugs in the treatment of NCC and CNS tuberculomas ($P = 0.00$).

Among 21 patients of NCC, 17 were non-vegetarian whereas four were strict vegetarian.

Among the 21 patients who diagnosed as NCC, all of them belong to the Hindu religion.

Among 21 patients of NCC, only one patient had ocular involvement.

All diagnosed patients NCC are divided into four stages as per given in the radiological investigation. There were three patients in stage one, seven patients in stage two as well as stage three and four patients in stage four.

Radiological differentiation between NCC and CNS tuberculoma out of 36 total patients enrolled in this study, CT brain was the first radiological investigation done in these patients due to easy availability and cheaper cost.

Among 36 patients 28 patients were subjected to CT brain (in remaining eight patients, a direct MRI brain was done). Out of 28 patients, CT brain reports of 13 suggestive of NCC and 15 suggestive of tuberculoma.

These patients were later subjected to MRI brain also. Among these 13 patients who were labeled as NCC initially was subjected to MRI brain, two patients were found to have tuberculoma on MRI brain whereas 11 patients were labeled as NCC. Whereas 15 patients were labeled as CNS tuberculoma after CT brain, MRI brain, and spectroscopy (whenever needed) were done and was found that 10 were tuberculoma while five were NCC.

Among 21 diagnosed patients of NCC 16 patients were subjected to CT brain initially and later on MRI, whereas in five patients MRI brain was done without doing CT brain.

Table 1: Age wise distribution

Age (years)	Study group		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
18–25	13 (61.9)	7 (46.7)	20 (55.6)
26–40	4 (19.0)	5 (33.3)	9 (25.0)
>40	4 (19.0)	3 (20.0)	7 (19.4)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	Df	*P*	Associationis
Pearson Chi-square	1.084	2	0.582	Not significant

NCC: Neurocysticercosis

Table 2: Gender-wise distribution

Sex	Study group		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Male	16 (76.2)	8 (53.3)	24 (66.7)
Female	5 (23.8)	7 (46.7)	12 (33.3)
Total	21 (100.0)	15 (100.0)	36 (100.0)

NCC: Neurocysticercosis

Table 3: Clinical features-wise distribution

Clinical feature	Study group		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Seizures	16 (76.2)	5 (33.3)	21 (58.3)
Altered sensorium	1 (4.8)	6 (40.0)	7 (19.4)
Headache	2 (9.5)	3 (20.0)	5 (13.9)
Hemiparesis	1 (4.8)	1 (6.7)	2 (5.6)
Outward deviation of left eye with ptosis	1 (4.8)	0	1 (2.8)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	df	*P*	Associations
Pearson Chi-square	9.806	4	0.044	Significant

NCC: Neurocysticercosis

Table 4: Constitutional symptoms-wise distribution

Constitutional symptoms	Study group, *n* (%)		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Yes	0	5 (33.3)	5 (13.9)
No	21 (100.0)	10 (66.7)	31 (86.1)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	df	*P*	Association is
Pearson Chi-square	8.129	1	0.004	Significant
Fisher's exact test			0.008	Significant

NCC: Neurocysticercosis

Among 15 diagnosed patients of CNS tuberculoma, 12 patients were subjected to CT initially and then from those 12 patients, eight were subjected to MRI/MRI spectroscopy.

Whereas in three patients, MRI was done directly without doing CT brain.

After MRI imaging, one patient out of 21 diagnosed NCC was showing features of tuberculoma on MRI but eventually diagnosed as NCC due to lack of evidence of TB elsewhere in the body or constitutional symptoms.

Table 5: Fundoscopy findings wise distribution

Funduscopy	Study group		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Normal	20 (95.2)	12 (80.0)	32 (88.9)
Papilledema	1 (4.8)	3 (20.00)	4 (11.1)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	Df	*P*	Association is
Pearson Chi-square	2.057	1	0.151	Not significant
Fisher's exact test			0.287	Not significant

NCC: Neurocysticercosis

Table 6: Antiedema-wise distribution

Antiedema	Study group, *n* (%)		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Given	16 (76.2)	(86.7)	29 (80.6)
Not given	5 (23.8)	2 (13.3)	7 (19.4)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	Df	*P*	Association is
Pearson Chi-square	0.613	1	0.434	Not significant
Fisher's exact test			0.674	Not significant

NCC: Neurocysticercosis

Table 7: Anticonvulsant wise distribution

Antiepileptics	St group		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Given	19 (90.5)	13 (86.7)	32 (88.9)
Not given	2 (9.5)	2 (13.3)	4 (11.1)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	df	*P*	Association is
Pearson Chi-square	0.129	1	0.720	Not significant
Fisher's exact test			1.000	Not significant

NCC: Neurocysticercosis

Table 8: Distribution according to use of scolicidal drugs

Scolicidal	St group		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Given	17 (81.0)	0	17 (47.2)
Not given	4 (19.0)	15 (100.0)	19 (52.8)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	df	*P*	Association is
Pearson Chi-square	23.008	1	0.000	Significant
Fisher's exact test			0.000	Significant

NCC: Neurocysticercosis

Table 9: Distribution according to use of antitubercular drugs

Antitubercular treatment	Study group		Total, *n* (%)
	NCC, *n* (%)	Tuberculoma, *n* (%)	
Given	1 (4.8)	15 (100.0)	16 (44.4)
Not given	20 (95.2)	0	20 (55.6)
Total	21 (100.0)	15 (100.0)	36 (100.0)

Chi-square test	Value	df	*P*	Associationis
Pearson Chi-square	32.143	1	0.000	Significant
Fisher's exact test			0.000	Significant

NCC: Neurocysticercosis

Table 10: Distribution of study group of neurocysticercosis according to diet

Diet	Frequency (%)
Veg	4 (26.67)
Veg + nonveg	17 (113.33)
Total	21 (140.00)

Among 15 patients of tuberculoma, no patient was labeled as NCC on MRI brain/MR spectroscopy.

MRI brain with spectroscopy was done in five patients of tuberculoma, all patients showed "lipid-lactate peak" on spectroscopy.

DISCUSSION

In the present study, the total number of patients included was 36. Out of which the number of NCC patients was 21 and number of tuberculoma patients was 15. This is in concurrence with a previous study. "Demographic and Clinical Presentation of Patients with Ring and Disc Enhancing Lesions on CT Scan" done in Latur, Maharashtra by Dhoot and Jagtap.[4]

Table 11: Distribution of study group according to religion

Religion	Frequency (%)
Hindu	21 (100.0)

Table 12: Distribution according to USG B scan

USG B scan	Frequency (%)
Normal	20 (133.33)
Ocular NCC (muscular)	1 (6.67)
Total	21 (140.00)

NCC: Neurocysticercosis

Table 13: Distribution according to stage of neurocysticercosis

Stage of NCC	Frequency (%)
Stage 1	3 (14.28)
Stage 2	7 (33.33)
Stage 3	7 (33.33)
Stage 4	4 (19.06)
Total	21 (100.00)

NCC: Neurocysticercosis

Table 14: CT scan findings

Parameters	
Total number of patients who were subjected to CT brain	28
Number of patients in which CT suggestive of NCC	13
Number of patients in which CT suggestive of CNS tuberculoma	15

NCC: Neurocysticercosis

In the present study, the maximum number of patients, that is, (20 55.56%) belong to the age group of <25 years whereas only 9 (25%) and 7 (19.4%) patients belongs to the age group of 26–40 years and more than 40 years, respectively. This is in concurrence with a previous study. "Demographic and Clinical Presentation of Patients with Ring and Disc Enhancing Lesions on CT Scan" done in Latur, Maharashtra by Dhoot and Jagtap.[4] This reflects that these CNS infections are more common in younger age group compared to elderly.

In the present study, among 21 patients of NCC, 16 (76.2%) were male and 5 (23.8%) were female whereas among 15 patients of CNS Tuberculoma, 8 (53.3%) were male and 7 (46.7%) were female. This is in concurrence with a previous study "Demographic and Clinical Presentation of Patients with Ring and Disc Enhancing Lesions on CT Scan" done in Latur, Maharashtra by Dhoot and Jagtap.[4]

Table 15: Patients subjected to MRI brain

Parameters		After MRI/MRI spectroscopy	After MRI/MRI spectroscopy
Number of patients whose CT suggestive of NCC	13	Among 13 patients 11 were diagnosed as NCC	Among 13 patients two were diagnosed as tuberculoma
Number of patients whose CT suggestive of tuberculoma	15	Among 15 patients 5 were diagnosed as NCC	Among 15 patients 11 were diagnosed as tuberculoma
	Total: 28	16 patients were finally diagnosed as NCC	12 patients were finally diagnosed as tuberculoma

NCC: Neurocysticercosis

In the present study, among 21 patients, 16 (76.2%) patients presented with seizure, 2 (9.5%) patients presented with headache, and 1 (4.8%) patient each presented with altered sensorium, hemiparesis and outward deviation of eye. Whereas among 15 patients of tuberculoma, 6 (40%) patients presented with altered sensorium, 5 (33.33%) presented with seizures, 3 (20%) presented with headache, and 1 (6.7%) presented with hemiparesis. This is in concurrence with a previous study "Demographic and Clinical Presentation of Patients with Ring and Disc Enhancing Lesions on CT Scan" done in Latur, Maharashtra by Dhoot and Jagtap.[4]

This reflects that seizure (convulsions) is the most common presenting complaint of patients with NCC whereas raised intracranial tension with headache is the most common presenting complaint in patients with CNS tuberculoma.

In the present study, 5 (33.33%) out of 15 patients of tuberculoma had constitutional symptoms of TB in the form of fever, anorexia, weight loss, etc. whereas none of the NCC patients had such constitutional symptoms. This study is in concurrence with the study conducted by Garg," TB of CNS".[5]

In the present study, three patients of tuberculoma and one patient of NCC found to have papilledema on funduscopy. This reflects that raised intracranial tension is common in tuberculoma than NCC.

This is in concurrence with a previous study "Demographic and Clinical Presentation of Patients with Ring and Disc Enhancing Lesions on CT Scan" done in Latur, Maharashtra by Dhoot and Jagtap.[4]

In present study, 16 (76.2%) out of 21 patients of NCC were given antiedema measures whereas 13 (86.7%) out of 15 patients of tuberculoma were given antiedema measures. This is in concurrence with the study "NCC versus CNS Tuberculoma in Children — Dilemma over Clinico-Radiological Diagnosis?" conducted in Gurgaon, India by Bharat-Bhushan Sharma and Shashi Sharma.[3] Corticosteroids are used as an adjunct to cysticidal therapy to control the inflammatory reaction that usually occurs 2–5 days after initiation of therapy and decrease the symptoms (headache, nausea, vomiting, and seizures) caused by the death of larvae. Its usage has not been standardized and is given empirically for a variable duration of 5–28 days.

In the present study, 19 out of 21 patients of NCC received antiepileptic drugs where 13 out of 15 patients of tuberculomas were given antiepileptic drugs either therapeutically or empirically. The seizures occurring with NCC may be either provoked or unprovoked according to the evolutionary stage of the cyst. Differentiating between provoked or acute symptomatic seizures and unprovoked seizures is vital in determining treatment and prognosis.

Patients with cysticerci in the degenerative phase develop acute symptomatic seizures because of the inflammatory response of the brain. Therefore these patients may be treated only for the duration of the acute condition, perhaps several months during which the inflammatory response is active. There are, however, no guidelines regarding the duration for which AED should be continued following an acute episode.

In the present study, 17 out of 21 patients of NCC were given scolicidal drugs in the form of albendazole, whereas remaining four patients were not given any scolicidal drug. On the other hand, all patients of CNS tuberculoma were treated with antitubercular drugs.

This is important to note that all patients NCC do not require treatment with scolicidal drugs as some patients present with calcified lesion on CT/MRI (stage 4 NCC) who actually does not require any scolicidal drugs. "For patients with only calcified lesions, there was also consensus that there was no role for antiparasitic agents because the cysts are already dead."[6]

But this is not same with CNS tuberculoma, each and every must be treated with antitubercular drugs. Hence in the present study, all patients diagnosed as CNS tuberculoma were treated with antitubercular drugs.

In the present study, 4 (19.04%) out of 21 patients of NCC were taking vegetarian diet whereas remaining 17

were non-vegetarian. In the past, NCC was supposed to be the disease of pork eaters but recent studies show that even vegetarian can get infected with NCC.

This is not in concurrence with the article "NCC – Indian scenario" by Singh and Sappal, Ludhiana. This article states that "Low proportion of pork eaters among Indian patients is the other unusual feature of the disease, <1–2% of patients with NCC admits eating pork and more than 95% of Indian patients with NCC are vegetarians."

In the present study, all 21 patients diagnosed with NCC were belonging to Hindu religion. This is not in concurrence with the study "Incidence of NCC Presenting with Seizure in a Tertiary Care Hospital in Western Nepal: A Cross-Sectional Observational Study" conducted by Mukhi and Salooja in Nepal.[7] This study suggested equal incidence of NCC among Hindu and Muslim religion.

In the present study, one patient (4.76%) was found to have ocular involvement of NCC. The parasite was in superior rectus muscle and the patient presented with ptosis and outward deviation of eye. Although ophthalmic cysticercosis is much less common than NCC (occurring in 1–3% of all infections), *T. solium* is the most common intraorbital parasite.[8]

In the present study, among 21 diagnosed cases of NCC All diagnosed patients NCC were divided into four stages as per given in radiological investigation. There were 3 patients (14.28%) in Stage 1, 7 patients (33.33%) in Stage 2 as well as Stage 3, and 4 patients (19.06%) in Stage 4.

This is not in concurrence with the study "Incidence of NCC Presenting with Seizure in a Tertiary Care Hospital in Western Nepal: A Cross-Sectional Observational Study" conducted by Mukhi and Salooja in Nepal.[7]

In the present study, 36 total patients were enrolled, CT brain was the first radiological investigation done in these patients because of easy availability and cheaper cost. Among 36 patients 28 patients were subjected to CT brain (in remaining eight patients, direct MRI brain was done).

Out of 28 patients, CT brain reports of 13 suggestive of NCC and 15 suggestive of tuberculoma.

CT brain with contrast is not completely accurate investigation for NCC or tuberculoma as CT shows calcification better but not early stages of NCC. Here starts the resemblance and confusion between NCC and CNS tuberculoma.

Due to similarities in presentation and radiological features, hence, many times even radiologist give CT report as NCC versus tuberculoma and advise for superior mode of imaging.

In the present study, as mentioned above, 13 patients who were reported as NCC were subjected to MRI/MRI spectroscopy and found that two patients were actually CNS tuberculomas.

Similarly, those 15 patients who were reported as tuberculoma were subjected to MRI/MR spectroscopy and found to have five out of 15 patients were actually NCC. Among 21 diagnosed patients of NCC 16 patients were subjected to CT brain initially and later on MRI, whereas in five patients MRI brain was done without doing CT brain.

Among 15 diagnosed patients of CNS tuberculoma, 12 patients were subjected to CT initially and then from those 12 patients, eight were subjected to MRI/MRI spectroscopy. Whereas in three patients, MRI was done directly without doing CT brain.

After MRI imaging, one patient out of 21 diagnosed NCC was showing features of tuberculoma on MRI and "lipid-lactate peak" on MRI spectroscopy but eventually diagnosed as NCC due previous history of NCC and to lack of evidence of TB elsewhere in the body or constitutional symptoms.

Among 15 patients of tuberculoma, no patient was labeled as NCC on MRI brain/MR spectroscopy. MRI was found to be more sensitive than CT in detecting live cysts, dying cysts, and cyst burden. MRI was superior in characterizing ring-enhancing lesions seen on CT. MRI was found inferior to CT in identifying dead calcified cysticerci.[9]

The main advantage of MR imaging over CT is its higher contrast resolution, which makes for better lesion conspicuity. This higher resolution is particularly helpful in the evaluation of ventricular involvement and the detection of inflammatory changes.[10,11]

MRI brain with spectroscopy was done in five patients of tuberculoma, all patients showed "lipid-lactate peak" on spectroscopy. This "Lipid lactate peak" is characteristically present in patients with tuberculoma.

Tuberculomas have high lipid peak, reduced NAA and creatinine, and a choline/creatinine ratio of >1. NCC demonstrates a high lactate and proteins such as alanine, succinate, glutamate, and glycine levels with some reduction of NAA and creatinine.

CONCLUSION

We conclude that NCC is the most common parasitic infection of the brain caused by *T. solium*. NCC is one

of the most common leading causes of seizures in India. Disease is more common in people with non-vegetarian diet but vegans also may get infected via the fecal-oral route.

A scenario, in which a patient presents with a ring-enhancing lesion if posing a diagnostic dilemma between NCC and tuberculoma, must be resolved to avoid antitubercular treatment in cases of NCC.

Although the prevalence of NCC is less than TB in India, still number of cases of NCC and tuberculoma which are diagnosed are nearly equal.

The clinical features of NCC mimics tuberculoma, although the incidence of seizures is more in NCC while incidence of altered sensorium with raised ICT is more frequent in tuberculoma. The establishment of distinguishing features between suspected NCC and tuberculoma is relevant because all cases of NCC may not require treatment as it may be a self-limiting condition whereas tuberculoma always requires prolonged treatment with potentially toxic drugs. The cases where there is no evidence of TB in the body and who do not have constitutional symptoms of TB in body, pose a diagnostic dilemma resolved by this study.

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