

**Prevalence of Toxoplasmosis among HIV/AIDS patients and Correlation of Radiological Investigations with Laboratory findings**

**Abstract**

**Introduction-** Toxoplasmosis is a worldwide neglected tropical disease caused by the intracellular protozoan named *Toxoplasma gondii*, which also causes severe disease in immunocompromised patients. Among patients with HIV/ AIDS, cerebral involvement is more common and more serious than extra-cerebral toxoplasmosis. The definitive diagnosis is crucial for cerebral toxoplasmosis patients by directly demonstrating the presence of the tachyzoite form of *Toxoplasma gondii* in the cerebral tissues. The presumptive diagnosis for cerebral toxoplasmosis, including the clinical presentations, radio-imaging findings, molecular and sero-diagnosis, and good response to anti-Toxoplasma therapy are widely accepted in clinical practice.

**Material and Methods-** The present prospective hospital based study was conducted in the Department of Microbiology, Government Medical College and Hospital, Nagpur, Maharashtra, India. A total of 362 HIV positive patients were included in this study by following criteria, either hospitalized or coming to ART clinic. The written informed consent was obtained from each study participants and detailed clinical history, all relevant investigations (including radiological for the diagnosis of toxoplasmosis) of each patient was noted. Specimens of blood for ELISA test were taken by venipuncture. Serum samples were then subjected to ELISA test for detecting anti-toxoplasma IgM and IgG antibodies as per the manufacturer's instructions. Data was compiled in MS Excel and checked for its completeness and correctness. Then it was analyzed.

**Observation-** Out of these 362 HIV positive patients, 226 (62.43%) were males and 136 (37.57%) were females. Most of the HIV positive patients, 359 (99.17%) were married and 313(86.46%) were from urban area whereas 49 (13.54%) were from rural area. Total 85 (23.48%) HIV positive patients were co-infected with toxoplasmosis. 65 (17.96%) were males and 20 (5.52%) were females. Majority of the co-infected patients were laborers 35 (9.67 %) followed by drivers, skilled employee, house wives, farmers and others were 17 (4.70%), 13 (3.60%), 12 (3.31%), 3 (0.82%) and 5 (1.38%) respectively Both the ELISA and

34 the CT-scan were simultaneously positive in 75 (20.72%) and negative in 172 (47.51%)  
35 cases, the overall correlation seen in 247 (68.23%). Radiological features suggestive of  
36 toxoplasmosis among HIV-toxoplasmosis co-infected patients in the CT-scan head. Out of  
37 these 85 HIV-toxoplasma co-infected patients, only hyper density was seen in 13 (15.29%)  
38 patients, only hypo density was present in 37 (43.52%) patients. Whereas, 25 (29.41%) cases  
39 showed only ring enhancement as the radiological feature. 4(4.70%) patients had hyper  
40 density and ring-enhancement features and 6 (7.05%) cases showed hypo density and ring-  
41 enhancement.

42

43 **Conclusion-** We conclude from this study that the prevalence of toxoplasmosis in HIV  
44 positive patients was high. Radiological investigations are good and provide better  
45 localization of toxoplasmosis but less confirmatory than ELISA.

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47 **Key words:** Toxoplasmosis, Sero-positivity, HIV/AIDS, ART Centre

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## 49 INTRODUCTION

50 *Toxoplasma gondii* causes severe disease in immunocompromised patients where reactivation  
51 of latent infection causes symptomatic disease<sup>1, 2</sup>. In immunocompromised individuals who  
52 previously acquired latent infection can lead to reactivated toxoplasmosis with encephalitis.  
53 Toxoplasmic encephalitis and disseminated toxoplasmosis have been observed in patients  
54 with immunodeficiency due to various causes, such as Hodgkin's disease or  
55 immunosuppressive therapy because of other malignancies. Disseminated toxoplasmosis may  
56 also complicate transplantation of organs or bone marrow. This may result either from  
57 transplantation of an organ from a *Toxoplasma gondii* infected donor to a susceptible  
58 recipient or from reactivation of a latent *Toxoplasma gondii* infection in the recipient due to  
59 immunosuppressive treatment.<sup>3-5</sup>

60

61 The initial presentation of toxoplasmic encephalitis in patients with AIDS may be subacute.  
62 Patients present with altered mental status (62%), headaches (59%), and fever (41%)  
63 associated with focal neurologic deficits. Progression of the infection can lead to confusion,  
64 drowsiness, seizures, hemiparesis, hemianopsia, aphasia, ataxia, and cranial nerve palsies.  
65 Motor weakness and speech disturbance are seen as the disease progresses. If not treated  
66 promptly, patients may progress to coma within days to weeks. Toxoplasmosis may rarely

67 present as a rapidly fatal form of diffuse or global encephalitis with profound mental status  
68 changes, nausea, and vomiting, usually indicating elevated intracranial pressure.<sup>6-10</sup>

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70 Among patients with AIDS, cerebral involvement is more common and more serious than  
71 extra-cerebral toxoplasmosis. The definitive diagnosis is crucial for cerebral toxoplasmosis  
72 patients by directly demonstrating the presence of the tachyzoite form of *Toxoplasma gondii*  
73 in the cerebral tissues. The presumptive diagnosis for cerebral toxoplasmosis, including the  
74 clinical presentations, radio-imaging findings, molecular and sero-diagnosis for Toxoplasma  
75 infection and good response to anti-toxoplasma therapy are widely accepted in clinical  
76 practice. The favorable outcome of cerebral toxoplasmosis is the improvement of clinical and  
77 radiological features after 2 to 3 weeks of initiated empirical therapy. The clinical diagnosis  
78 is a dilemma because cerebral toxoplasmosis mimics with other brain diseases making it  
79 difficult to diagnose. Differential diagnosis of AIDS-associated cerebral toxoplasmosis is  
80 extremely important and the local neuro-epidemiology and the degree of immunosuppression  
81 in the host are two key factors involved. Primary CNS lymphoma is the main differential  
82 diagnosis of cerebral toxoplasmosis reported from developed countries. While, focal forms of  
83 cerebral tuberculosis (tuberculoma and, less likely tuberculous brain abscess) allow for  
84 differential diagnosis of cerebral toxoplasmosis mainly in developing countries.<sup>11-13</sup>

85

86 Radio-imaging findings, either by computed tomography (CAT scan) or magnetic resonance  
87 imaging (MRI), are useful tools for the presumptive or empirical diagnosis of cerebral  
88 toxoplasmosis. Cerebral toxoplasmosis usually causes unifocal, and more frequently  
89 multifocal lesions, and less likely diffuse encephalitis. These findings are however not  
90 pathognomonic of cerebral toxoplasmosis. Radiological diagnosis can be classified as typical  
91 findings of hypodense lesions with ring enhancing and perilesional edema are observed in  
92 nearly 80% of cerebral toxoplasmosis cases.<sup>14</sup>

93

94 Cerebral toxoplasmosis poses a diagnostic problem that relies on classical serological  
95 methods to detect anti-toxoplasma immunoglobulins because clinical blood samples from  
96 patients with immunodeficiency can fail to produce sufficient titers of specific antibodies.  
97 Sero-evidence of toxoplasma infection, independent of antibody levels is generally seen in all  
98 patients before developing cerebral toxoplasmosis. Most cerebral toxoplasmosis patients have  
99 high titers of anti-toxoplasma IgG antibodies with high IgG avidity that provides serological

100 evidence of infection and this also supports a conclusion that this is the result of a secondary  
101 reactivation of latent or chronic toxoplasma infection. Therefore, it is important to determine  
102 the toxoplasma sero-status in all HIV-infected patients in order to define the population at  
103 risk for cerebral toxoplasmosis. At the onset of cerebral toxoplasmosis, significant rises in  
104 anti-toxoplasma antibody titers are found in only a marginal number of these patients. The  
105 level of rising titers may occur before the onset of cerebral toxoplasmosis and it does not  
106 seem to predict the occurrence of cerebral toxoplasmosis. Anti-Toxoplasma IgM antibody, as  
107 measured by the indirect fluorescent or ELISA tests, is rarely found in cerebral toxoplasmosis  
108 patients. In cases of cerebral toxoplasmosis, a negative or low titer of serological results or  
109 even the absence of anti-toxoplasma antibodies does not exclude positive diagnosis and the  
110 anti-toxoplasma therapy should be started without delay if clinical and radiological  
111 presentations are consistent with cerebral toxoplasmosis. A positive serology result seems to  
112 be even less useful in areas where there is a high prevalence of toxoplasmosis in the general  
113 population, while a negative result does have a high negative predictive value.<sup>15-16</sup> Therefore,  
114 the present study was undertaken to assess the prevalence of toxoplasmosis among HIV  
115 patients and role of radiological investigation in the diagnosis.

116

## 117 **MATERIAL AND METHODS**

118

### 119 **Study design**

120 The present prospective hospital based study was conducted in the Department of  
121 Microbiology, Government Medical College and Hospital, Nagpur, Maharashtra, India. A  
122 total of 362 HIV positive patients included through following criteria, either hospitalized or  
123 coming to ART clinic during this study period.

124

### 125 **Inclusion criteria**

126 All volunteered confirmed HIV/AIDS positive patients with CNS signs and symptoms  
127 suggestive of toxoplasmosis were included in this study.

128

### 129 **Exclusion criteria**

130 Patients with immunocompromised status due to other than HIV infection were excluded  
131 from this study.

132

133 To maintain the strict confidentiality and to conceal the identity of the patient, coding system  
134 for sample was followed which was known only to investigator. After taking written  
135 informed consent, detailed clinical history and all relevant investigations (including  
136 radiological for the diagnosis of toxoplasmosis) of each patient was done and findings were  
137 noted as per standard predesigned and pretested clinical proforma.

138

139 Specimens of blood to provide the sera for ELISA test were taken by venipuncture. At least  
140 5ml of blood was obtained to ensure that there will be enough serum for the test. Immediately  
141 blood was transferred from the syringe into dry stoppered sterile tube and allowed to clot.  
142 When the serum has separated, it was pipetted off into a sterile tube.<sup>17</sup> Serum samples were  
143 then subjected to ELISA test for detecting anti-toxoplasma IgM and IgG antibodies as per the  
144 manufacturer's instructions. Process was performed as per standard protocol.<sup>18</sup>

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146 Data was compiled in MS Excel and checked for its completeness and correctness. Then it  
147 was analyzed. Final diagnosis (based on ELISA) was compared with the Radiological  
148 findings to assess the accuracy of radiological investigations. Online statistical calculator  
149 was also used and qualitative test were applied with p value of < 0.05 was considered  
150 statistically significant for interpretation of the findings. The prior ethical approval was  
151 sought for this study by the institutional ethics committee.

152

## 153 **RESULTS**

154 Out of these 362 HIV positive patients, 226 (62.43%) were males and 136 (37.57%) were  
155 females. Most of the HIV positive patients, 359 (99.17%) were married and only 3 (0.83%)  
156 were unmarried and 313(86.46%) were from urban area whereas 49 (13.54%) were from  
157 rural area. Majority of the patients were laborers 144 (39.78%) followed by house wives,  
158 skilled employee, drivers, farmers and others were 75 (20.72%), 64 (17.68%), 52 (14.91%),  
159 12 (3.31%) and 15 (4.14%) respectively. Total 85 (23.48%) HIV positive patients were co-  
160 infected with toxoplasmosis. 65 (17.96%) were males and 20 (5.52%) were females. All of  
161 the co-infected patients were married and 78 (21.55%) were from urban area whereas 7  
162 (1.93%) were from rural area. Majority of the co-infected patients were laborers 35 (9.67 %)  
163 followed by drivers, skilled employee, house wives, farmers and others were 17 (4.70%), 13  
164 (3.60%), 12 (3.31%), 3 (0.82%) and 5 (1.38%) respectively (**Table 1**).

165

166 **Table 1: Prevalence of Toxoplasmosis co-infection among HIV positive patients**  
 167 **according to socio-demography.**

168

<b>Variables</b>	<b>HIV Positive (%) N=362</b>	<b>IgG positive (%) (%), N=71</b>	<b>P value</b>	<b>IgM positive (%) (%), N=14</b>	<b>P value</b>	<b>IgG + IgM (%)</b>
<b>Age in Years</b>						
15-24	23 (6.32)	3 (0.82)	0.488	0 (0)	0.734	3 (0.82)
25-34	171(47.23)	32 (8.84)		6 (1.66)		38 (10.50)
35-44	133(36.74)	31 (8.56)		5 (1.38)		36 (9.94)
45-54	29(8.01)	5 (1.38)		2 (0.55)		7 (1.93)
55 and above	6 (1.66)	0 (0)		1 (0.28)		1 (0.28)
<b>Total</b>	<b>362 (100)</b>	<b>71(19.61)</b>		<b>14 (3.86)</b>		<b>85 (23.48)</b>
<b>Sex</b>						
Male	226 (62.43)	53 (14.72)	0.018*	12 (3.31)	0.093	65 (17.96)
Female	136(37.57)	18 (4.97)		2 (0.55)		20 (5.52)
<b>Marital Status</b>						
Married	359 (99.17)	71 (19.61)	0.390	14 (3.86)	0.737	85 (23.48)
Unmarried	3 (0.83)	0 (0)		0 (0)		0 (0)
<b>Residence</b>						
Rural	49(13.54)	6 (1.66)	0.162	1 (0.28)	0.531	7 (1.93)
Urban	313 (86.46)	65 (17.96)		13 (3.60)		78 (21.55)
<b>Occupation</b>						
Driver	52 (14.91)	15 (4.14)	0.488	2 (0.55)	0.749	17 (4.70)
Farmer	12 (3.31)	3 (0.82)		0 (0)		3 (0.82)
Laborer	144 (39.78)	28 (7.73)		7 (1.93)		35 (9.67)
Housewife	75 (20.72)	11 (3.03)		1 (0.28)		12 (3.31)
Skilled Employee	64 (17.68)	11 (3.03)		2 (0.55)		13 (3.60)
Others	15 (4.14)	3 (0.82)		2 (0.55)		5 (1.38)

169

170

171 **Table 2: Prevalence of Toxoplasmosis co-infection among HIV positive patients**  
 172 **according to signs, symptoms and other risk factors.**

<b>Variables</b>	<b>IgG positive (%)</b>	<b>P value</b>	<b>IgM positive (%)</b>	<b>P value</b>	<b>IgG + IgM</b>
<b>Signs and symptoms</b>					
Headache	68 (18.78)	0.000*	12 (3.31)	0.019*	80 (22.10)
Fever	57 (15.75)	0.000*	12 (3.31)	0.013*	69 (19.06)
Increased	21 (5.80)	0.555	8 (2.20)	0.004*	29 (8.01)

intracranial tension					
Seizure	6 (1.66)	0.898	5 (1.38)	0.000*	11(3.04)
Altered sensorium	4 (1.10)	0.573	3 (0.82)	0.024*	7 (1.93)
Papilloedema	6 (1.66)	0.095	3 (0.82)	0.001*	9 (2.49)
Cerebellar sign	2 (0.55)	0.547	0 (0)	-	2 (0.56)
<b>History of pet contact</b>					
Yes	37 (10.22)	0.000*	6 (1.66)	0.002*	43 (11.88)
No	34 (9.40)		8 (2.20)		42 (11.60)
<b>History of meat ingestion</b>					
Yes	54 (14.91)	0.000*	13 (3.600)	0.000*	67 (18.50)
No	17 (4.70)		1 (0.28)		18 (4.98)
<b>Past history of Toxoplasmosis</b>					
Yes	5 (1.38)	0.000*	0 (0)	-	5 (1.38)
No	66 (18.23)		14 (3.87)		80 (22.10)
<b>Mode of Transmission</b>					
STD	64 (17.68)	0.487	12 (3.31)	0.516	76 (20.10)
Blood transfusion	0 (0)		0 (0)		0 (0)
Unknown	7 (1.93)		2 (0.55)		9 (2.49)
<b>CD4 cell count</b>					
<100	20 (5.52)	0.227	2 (0.55)	0.292	22 (6.08)
101-200	10 (2.76)		3 (0.82)		13 (3.60)
201-500	28 (7.73)		9 (2.49)		37 (10.22)
>501	13 (3.59)		0 (0)		13 (3.60)
<b>Response to treatment</b>					
Yes	51 (14.10)	0.000*	12 (3.31)	0.000*	63 (17.40)
No	20 (5.52)		2 (0.55)		22 (6.08)

173

174 As shown in **table 2**, the toxoplasmosis co-infection among HIV positive patients according  
175 to signs, symptoms and other risk factors was assessed. The signs and symptoms associated  
176 with co-infection showed that majority of the patients had headache (80 (22.10%) and fever  
177 (69 (19.06%). Whereas, 29 (8.01%), 11(3.04%), 7 (1.93%), 9 (2.49%) and 2 (0.56%) co-  
178 infected patients had symptoms of increased intracranial tension, seizure, altered sensorium,  
179 papillo-edema and cerebellar signs respectively. Almost half of the patients (43 (11.88%) had  
180 history of pet contact, 67 (18.50%) history of meat ingestion and 5 (1.38%) had past history  
181 of toxoplasmosis, which were statistically significant. Mode of transmission was through

182 sexual contact among 76 (20.10%), whereas, among 9 (2.49%) patients the transmission was  
 183 unknown. Decreased CD4 cell count was observed <100 among 22 (6.08%), 101-200, 201-  
 184 500 and >501 CD4 cells among 13 (3.60%), 37 (10.22%) and 13 (3.60%) respectively.  
 185 However, majority of the patients, 63 (17.40%) responded to treatment.

186

187 **Table 3: Correlation between radiological features in CT-scan head and ELISA for**  
 188 **anti-toxoplasma antibodies**

Radiology	ELISA		Total (%)
	Positive (%)	Negative (%)	
Positive	75(20.72)	105(29.00)	180(49.72)
Negative	10(2.76)	172(47.51)	182(50.28)
Total (%)	85(23.48)	277(76.52)	362(100)

189 McNemars  $\chi^2$  test=78.48 (Software used: Stata ver.10.0), Odd's Ratio =12.29, 95%  
 190 Confidence Interval = (5.84-26.53); p value <0.0001 considered significant.

191

192 The correlation between the ELISA sero-positivity and radiological feature is shown in **Table**  
 193 **3 and 4**, both the ELISA and the CT–scan were simultaneously positive in 75 (20.72%) and  
 194 negative in 172(47.51%) cases, the overall correlation seen in 247(68.23%). Strong  
 195 association between ELISA and CT-scan by McNemars  $\chi^2$  test was found. 10 (2.76%) cases  
 196 were positive by ELISA and negative by radiological examination for toxoplasma. The Odds  
 197 ratio was found to be 12.29 with 95% CI = (5.84-26.53) which was found to be statistically  
 198 significant.

199 **Table 4: Comparative evaluation of Radiological test with ELISA**

Statistic	Formula	Value	95% CI
Sensitivity	$\frac{a}{a + b}$	88.24%	79.43% to 94.21%
Specificity	$\frac{d}{c + d}$	62.09 %	56.10% to 67.83%
Positive Likelihood Ratio	$\frac{\text{Sensitivity}}{100 - \text{Specificity}}$	2.33	1.96 to 2.76
Negative Likelihood Ratio	$\frac{100 - \text{Sensitivity}}{\text{Specificity}}$	0.19	0.11 to 0.34



Positive Predictive Value	$\frac{a}{a+c}$	41.67% (*)	34.38% to 49.23%
Negative Predictive Value	$\frac{d}{b+d}$	94.51 % (*)	90.13% to 97.33%

200

201 **Table 5: Radiological features in HIV-toxoplasmosis co-infected patients (N=85).**

202

Radiological features	No. of cases (%)	p-value
Only Hyperdensity	13(15.29)	0.408
Only Hypodensity	37(43.52)	0.026*
Only Ring-enhancement	25(29.41)	0.00*
Hyperdensity + Ring-enhancement	04(4.70)	0.384
Hypodensity + Ring-enhancement	06(7.05)	0.280
Total (%)	85(100)	-

203

204 **Table 5** shows the radiological features suggestive of toxoplasmosis in HIV-toxoplasmosis  
 205 co-infected patients in the CT-scan head. Out of these 85 HIV-toxoplasma co-infected  
 206 patients, only hyper density was seen in 13(15.29%) patients, only hypo-density was present  
 207 in 37 (43.52%) patients. Whereas, 25 (29.41%) cases showed only ring enhancement as the  
 208 radiological feature. Only 4 (4.70%) patients had hyper density and ring-enhancement  
 209 features. Whereas, 6(7.05%) cases showed hypo density and ring-enhancement. Only hypo  
 210 density and only ring-enhancement were the radiological features which were found to be  
 211 statistically significant (p<0.05).

212

## 213 **DISCUSSION**

214 Toxoplasmosis is the most common opportunistic infection in HIV-infected patients. A high  
 215 seroprevalence of anti-*Toxoplasma gondii* IgG antibody has been reported in HIV-infected  
 216 subjects<sup>19-21</sup>. To our understanding, there is no adequate information on the prevalence of  
 217 *Toxoplasma gondii* infection in HIV/AIDS patients in India. In our study, the seroprevalence  
 218 of *Toxoplasma gondii* showed 23.48%. The co-infection occurred most among married male  
 219 from urban population with the history of pet contact, meat ingestion and unsafe sexual  
 220 activity. This rate is almost comparable with the other studies reported elsewhere such as

221 study by Holliman 1990, in which the seropositivity of toxoplasmosis found to be 26.06%,  
222 Sykora et al 1992 found seropositivity of toxoplasmosis 29.8% in HIV positive patients.  
223 Brindle et al 1991 found seropositivity of toxoplasmosis to be 22%. Oksenhendler et al 1994  
224 found that 25.4% was seropositivity rate. Similarly, Minkoff et al 1997 found that 20.2% was  
225 the seroprevalence of toxoplasmosis. Millogo et al 2000 found seropositivity in 25.4%. The  
226 seropositivity was found as 67.8%, 23.2%, 22.4%, & 21% by studies conducted by different  
227 authors like Sukthana et al 2000, Nissapatorn et al 2001 and Nissapatorn et al 2002,  
228 respectively. Also, Hari et al 2007, Akanmu et al 2010 and Oshinaike et al 2010, carried out  
229 study to find out seroprevalence of toxoplasmosis and found out to be 8%, 54% and 85.5%  
230 respectively<sup>22-33</sup>. Our study demonstrates that the high prevalence of *Toxoplasma gondii* co-  
231 infection in HIV/ AIDS patients suggesting that HIV-infected populations should be  
232 protected from *Toxoplasma gondii* infection to reduce the prevalence and morbidity and  
233 burden of the disease.

234

235 In the present study, both the ELISA and the CT-scan were simultaneously positive in 75  
236 (20.72%) and negative in 172 (47.51%) cases, the overall correlation seen in 247 (68.23%).  
237 In fact we found strong association between ELISA and CT-scan by McNemars  $\chi^2$  test.  
238 Software used for the analysis of the data was Stata ver.10.0. Also,  $p=0.000$  was found to be  
239 highly significant. A study was done by Venugopal A et al 2012, among AIDS patients in a  
240 tertiary care hospital in Mangalore, India<sup>34</sup>. It was a retrospective study done by reviewing  
241 medical records of HIV-positive diagnosed with toxoplasmosis from Jan 2000 to Dec 2010.  
242 Diagnosis was based on clinical features, demonstration of elevated IgG by ELISA and  
243 associated CT-scan findings. 2826 HIV positives attended Infections Disease Cell from 2000  
244 –2010, of which 33 (1.12%) had CNS toxoplasmosis. Mean level of IgG was 255.69. CT /  
245 MRI finding of ring enhancing lesion or cerebritis was seen in 79 % of the cases with 18% of  
246 lesions in both basal ganglia and parietal lobes. Cerebritis was most common lesion in  
247 CT/MRI, seen in 16 cases while ring enhancing lesions were seen in 10 cases. 82% improved  
248 with treatment and 18% died of complications. The possibility of cerebral toxoplasmosis  
249 should be considered in every HIV-positive patient with neurological symptoms parietal lobe  
250 lesions were common in their study, contrary to other existing data which say toxoplasma  
251 lesions are usually midline lesions.

252

253 In the present study, out of these 85 HIV-toxoplasma co-infected patients, only hyperdensity  
254 was seen in 13(15.29%) patients, only hypodensity was present in 37 (43.52%) patients  
255 whereas 25 (29.41%) cases showed only ring enhancement as the radiological feature. 4  
256 (4.70%) patients had both hyperdensity& ring-enhancement features whereas 6(7.05%) cases  
257 showed hypodensity and ring-enhancement simultaneously. Similar radiological features  
258 were reported by other studies. In a study done by Vidal et al 2005a, they found that typical  
259 findings of hypodense lesions with ring enhancing and perilesional edema were present in  
260 nearly 80% of cerebral toxoplasma patients<sup>10</sup>. And in nearly 20% cases a typical pattern of  
261 hypodense lesions without contrast enhancing and with an expansive effect, cerebral  
262 toxoplasma patients without focal lesions and MRI demonstrating focal lesions and diffuse  
263 cerebral encephalitis without visible focal lesions was found. In another study carried out by  
264 Pereira-Chioccola VL and Vidal JE, Sao Paulo in patients with toxoplasma encephalitis  
265 various lesions found were hypodense lesion with ring-enhancing and perilesional edema,  
266 nodular enhancing and perilesional edema and ring-enhancing lesion with small, enhancing  
267 asymmetric nodule along wall of the lesions <sup>15</sup>.

268

## 269 **CONCLUSION**

270 We conclude that from findings of this study the prevalence of toxoplasmosis in HIV positive  
271 patients was high, especially among married male patients from urban area having contact  
272 with pet animals, history of meat ingestion and major transmission by unsafe sexual activities  
273 with most common symptoms of headache, fever, increased intracranial tension and seizure.  
274 Although Radiological investigations are good and provide better localization of  
275 toxoplasmosis but less confirmatory than ELISA. So combination of modalities should be  
276 used in diagnosis of toxoplasmosis for appropriate management.

277

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