Int J Clin Exp Med 2015;8(9):16640-16645
www.ijcem.com /ISSN:1940-5901/IJCEM0008041

Original Article

Comparative analysis of intestinal parasitic infections of outpatients in Guangxi medical university affiliated hospital in 2005 and 2013

Deng-Yu Liu, Zuo-Chao Lu, Xiao-Quan Liu, Ting-Zheng Zhan, Li-Li Tang, De-Jun Liao, Ji-Qing Shen, Shan-Shan He, Huan-Huan Shi, Yan-Wen Li

Department of Parasitology, Guangxi Medical University, Nanning 530021, Guangxi, P. R. China

Received March 15, 2015; Accepted July 22, 2015; Epub September 15, 2015; Published September 30, 2015

Abstract: Objective: To understand the hospital's status and trends of intestinal parasitic infections and to provide a reference for prevention. Methods: Stool samples were treated by acid-ether centrifugation; iodine staining and direct-smearing were performed; intestinal parasites were examined under a microscope; characteristics of parasitic infections in population were analyzed using the descriptive epidemiological method. Results: 10 kinds of parasites were detected; the infection rate of clonorchissinensis was the highest, followed by B. hominis, hookworm, whipworm and roundworm in order (x^2 = 131.188, 1261.928, 129.386, P < 0.01); The overall infection rates in 2013 and 2005 were 37.08% and 41.07% respectively, and the infection rate in 2013 was lower than that in 2005 (x^2 = 20.5003, P < 0.01); All the infection rates of clonorchissinensis, hookworm, whipworm and roundworm in 2013 were lower than those in 2005 (x^2 = 18.275, 45.449, 34.855, 12.435, P < 0.01); Both in 2005 and 2013, the male infection rate was higher than that in female (x^2 = 12.859, 24.924, P < 0.01); For male, the infection rate of clonorchissinensis was the highest, followed by B. hominis (x^2 = 313.621, 104.409, P < 0.01); for female, the infection rate of B. hominis was the highest, followed by clonorchissinensis (x^2 = 95.293, 43.357, P < 0.01). For male, the age group of 41~ had the highest infection rate of clonorchissinensis in 2005 (x^2 = 5.734, P < 0.05), and the age groups of 31~ and 41~ had the highest infection rate of clonorchissinensis in 2013 (x^2 = 8.908, P < 0.01); for female, both in 2005 and 2013, the age group of 21~, 31~, 41~ and 51~ had the highest infection rate of clonorchissinensis (x^2 = 6.508, 5.145, P < 0.05). There was no difference in male infection rate of B. hominis in 2005 (x^2 = 10.134, P > 0.05); in 2013, the age group of 0~ had the highest infection rate (x^2 = 3.825, P < 0.05); for women, it was the highest in the age groups of 11~, 21~ and 31~ in 2005 (x^2 = 10.459, P < 0.01), 0~ and 11~ in 2013 (x^2 = 53.669, P < 0.01). For Hookworm infection in male, the highest infection rate was found in the age group of 11~ 21~ and 61~ in 2005 (x^2 = 4.547, P < 0.05), 61~ and ≥ 71~ in 2013 (x^2 = 4.843, P < 0.05); for female, the highest infection rate was found in the age groups of 51~ and 61~ both in 2005 and 2013 (x^2 = 5.709, 5.958, P < 0.05). Conclusion: In Nanning city, although there was a decline in the infection rate of intestinal parasites of attenders compared with 8 years ago, the infection rate was still high and intestinal parasites were various; The infection rate of geohelminthes had been reduced to a low level; Clonorchissinensis and B. hominis were still the insect species with the highest infection rate.

Keywords: Intestinal parasites, infection rates

Introduction

Nanning in Guangxi province is located in the subtropical regions, with warm and humid climate, underdeveloped economic, and natural, biological and social factors which are suitable for the growth and reproduction of parasites. The national survey of parasitic diseases in 2004 showed that the prevalence of parasitic diseases in Guangxi was still serious [1]. In recent years, the development of Guangxi is rapid, and a variety of social factors (such as people's economic status, education level, living conditions, lifestyle and health care) have changed a lot, playing a leading role the prevalence of parasitic diseases. In this study, the comparative analysis of intestinal parasitic infections of 12313 patients in 2005 and 2013 was conducted to understand the status and trends of intestinal parasitic infections, provid-

Table 1. Comparison of intestinal parasite infection rate (%)*

Insects	Number of infections in 2005 (%)			Number of infections in 2013 (%)		
	Male	Female	Total	Male	Female	Total
Clonorchissinensis	1277 (29.38)	178 (10.29)	1455 (23.94)	1093 (24.58)	199 (11.12)	1292 (20.72)
B. hominis	597 (13.73)	392 (22.66)	989 (16.27)	705 (15.86)	341 (19.05)	1046 (16.77)
Hookworm	129 (2.97)	122 (7.05)	251 (4.13)	64 (1.44)	62 (3.46)	126 (2.02)
Whipworm	42 (0.97)	21 (1.21)	63 (1.04)	7 (0.16)	5 (0.28)	12 (0.19)
Roundworm	22 (0.51)	15 (0.87)	37 (0.61)	4 (0.09)	8 (0.45)	12 (0.19)
Strongyloidesstercoralis	7 (0.16)	2 (0.12)	9 (0.15)	1 (0.02)	1 (0.05)	2 (0.03)
E. histolytica	7 (0.16)	9 (0.52)	16 (0.26)	2 (0.04)	1 (0.05)	3 (0.05)
Giardia lamblia	2 (0.05)	0	2 (0.03)	2 (0.04)	0	2 (0.03)
Pinworm	0	3 (0.17)	3 (0.05)	0	0	0
Fasciolopsis buski	0	0	0	1 (0.02)	3 (0.16)	4 (0.06)
Total number of infections	1848 (42.51)	648 (37.46)	2496 (41.07)	1735 (39.02)	577 (32.23)	2312 (37.08)
Number of detected patients	4347	1730	6077	4446	1790	6236

*: Infection rate (%) = Number of infections/Number of detected patients *100.

ing a reference for clinical diagnosis and prevention; the results we reported as follows.

Materials and methods

Subjects

12313 patients admitted to 5 general hospitals, including First Affiliated Hospital of Guangxi Medical University, People's Hospital of Guangxi Zhuang Autonomous Region, First People's Hospital of Nanning City in Guangxi Zhuang Autonomous Region, Second People's Hospital of Nanning in Guangxi Zhuang Autonomous Region, and First Affiliated Hospital of Guangxi Traditional Chinese Medical University, in Nanning from 2005 to 2013, including 8793 males and 3520 females.

All the patients were in the hospital or in the clinic outpatient who were suspected of parasitic infection and the parasite was carried out by the stool. The included subjects were account for 80%, 10%, 5%, 3%, 2% of the total patients from the above 5 hospitals, respectively.

Detecting method

Stool samples were treated by acid-ether centrifugation; two direct smearing sections and one iodine-stained section were detected for each sample; an additional section of saline smearing was performed for diarrhea stools to observe active trophozoites.

Statistical analysis

Excel 2007 was used to establish a database; SPSS 16.0 software was used for statistical analysis; Measurement data were compared using t test, and count data were analyzed using X^2 test. $P < 0.05$ was considered statistically significant.

Results

Insects and infection rates of Intestinal parasites

10 kinds of parasites were detected (**Table 1**), including clonorchissinensis, B. hominis, hookworm, whipworm, roundworm, Strongyloidesstercoralis, E. histolytica, Giardia lamblia, pinworm and Fasciolopsisbuski; Fasciolopsisbuski was detected in 2013 instead of pinworm; the infection rate of clonorchissinensis was the highest, followed by B. hominis, hookworm, whipworm and roundworm in order (x^2 = 131.188, 1261.928, 129.386, $P < 0.01$); The overall infection rates in 2013 and 2005 were 37.08% and 41.07% respectively, and the infection rate in 2013 was lower than that in 2005 (x^2 = 20.5003, $P < 0.01$); All the infection rates of clonorchissinensis, hookworm, whipworm and roundworm in 2013 were lower than those in 2005 (x^2 = 18.275, 45.449, 34.855, 12.435, $P < 0.01$); there was no statistically significant difference in the infection rate of B. hominis between 2013 (16.77%) and 2005 (16.27%) (x^2 = 0.52, $P > 0.05$); From the per-

Table 2. Mixed infection analysis of intestinal parasites

Number of species	Number of infections in 2005 (%)			Number of infections in 2013 (%)		
	Male	Female	Total	Male	Female	Total
2	215 (4.95)	83 (4.8)	298 (4.90)	140 (3.15)	41 (2.29)	181 (2.90)
3	10 (0.23)	4 (0.23)	14 (0.23)	2 (0.04)	1 (0.06)	3 (0.05)
4	0	1 (0.06)	1 (0.02)	0	0	0
Total	225 (5.18)	88 (5.09)	313 (5.15)	142 (3.19)	42 (2.35)	184 (2.95)
Number of detected patients	4347	1730	6077	4446	1790	6236

Table 3. Multi-insect infection analysis

Insects	Infection cases in 2005 (%)			Infection cases in 2012 (%)		
	Male	Female	Total	Male	Female	Total
Liver fluke + B. hominis	140	24	164	116	23	139
Liver fluke + hookworm	33	7	40	13	9	22
Liver fluke + whipworm	6	1	7	2	0	2
Liver fluke + Strongyloidesstercoralis	4	0	4	0	0	0
Liver fluke + roundworm	2	1	3	0	1	1
Liver fluke + E. histolytica	2	1	3	0	0	0
Liver fluke + Giardia lamblia	1	0	1	1	0	1
B. hominis + hookworm	12	22	34	4	5	9
B. hominis + whipworm	5	1	6	1	0	1
B. hominis + amoeba	1	8	9	1	0	1
B. hominis + roundworm	0	1	1	1	0	1
B. hominis + Strongyloidesstercoralis	0	1	1	0	0	0
Hookworm + whipworm	4	4	8	0	0	0
Hookworm + roundworm	2	6	8	1	3	4
Roundworm + whipworm	2	6	8	0	0	0
Coccidia + amoeba	1	0	1	0	0	0
Liver fluke + B. hominis + hookworm	4	2	6	2	1	3
Liver fluke + Roundworm + whipworm	2	1	3	0	0	0
Liver fluke + B. hominis + Roundworm	1	0	1	0	0	0
Liver fluke + B. hominis + E. histolytica	1	0	1	0	0	0
Liver fluke + hookworm + whipworm	0	1	1	0	0	0
Hookworm + Roundworm + whipworm	1	0	1	0	0	0
Hookworm + Roundworm + B. hominis	1	0	1	0	0	0
Hookworm + Roundworm + whipworm + B. hominis	0	1	1	0	0	0
Total	225	88	313	142	42	184

spective of gender, male and female infection rates were 42.51% and 37.46% in 2005, respectively, which were 39.02% and 32.23% in 2013; the male infection rate was higher than that of female (x^2 = 12.859, 24.924, P < 0.01); In 2005 and 2013, for male, the infection rate of clonorchissinensis was the highest, followed by B. hominis (x^2 = 313.621, 104.409, P < 0.01); for female, the infection rate of B. hominis was the highest, followed by clonorchissinensis (x^2 = 95.293, 43.357, P < 0.01). The infection rate of clonorchissinensis of male was higher than that of female; the infection rates of B. hominis and Hookworm were higher than those of male (x^2 = 65.524, 76.857, P < 0.01).

Multi-insect infection of intestinal parasites

The multi-insect infection rate in 2013 (2.95%) was lower than that in 2005 (5.15%) (x^2 = 37.889, P < 0.01, **Table 2**), without significant

Table 4. The distribution of infection in different ages

Years	ages	Male (%)				Female (%)			
		Number of patients	Clonorchissinensis	B. hominis	Hookworm	Number of patients	Clonorchissinensis	B. hominis	Hookworm
2005	0~	158	10 (6.33)	24 (15.19)	0	46	1 (2.17)	11 (23.91)	0
	11~	224	19 (8.48)	42 (18.75)	9 (4.02)	107	4 (3.74)	29 (27.10)	6 (5.61)
	21~	708	177 (25.0)	111 (15.68)	40 (5.65)	317	35 (11.04)	87 (27.44)	11 (3.47)
	31~	1176	394 (33.5)	160 (13.61)	21 (1.79)	435	59 (13.56)	118 (27.13)	20 (4.6)
	41~	991	382 (38.55)	122 (12.31)	17 (1.72)	370	42 (11.35)	79 (21.35)	27 (7.3)
	51~	553	175 (31.65)	71 (12.84)	18 (3.25)	250	22 (8.80)	43 (17.20)	32 (12.80)
	61~	300	83 (27.67)	40 (13.33)	20 (6.67)	134	10 (7.46)	20 (14.93)	24 (17.91)
	≥ 71	237	37 (15.61)	27 (11.39)	4 (1.69)	71	5 (7.04)	5 (7.04)	2 (2.82)
	Total	4347	1277 (29.38)	597 (13.73)	129 (2.97)	1730	178 (10.29)	392 (22.66)	122 (7.05)
2013	0~	391	11 (2.81)	147 (37.6)	1 (0.25)	263	1 (0.38)	104 (39.54)	0
	11~	193	10 (5.18)	56 (29.02)	2 (1.04)	71	3 (4.23)	21 (29.58)	2 (2.82)
	21~	568	113 (19.89)	95 (16.73)	8 (1.41)	231	32 (13.85)	39 (16.88)	4 (1.73)
	31~	983	300 (30.52)	124 (12.61)	12 (1.22)	351	50 (14.24)	53 (15.1)	10 (2.85)
	41~	1033	343 (33.2)	113 (10.94)	10 (0.97)	320	57 (17.81)	40 (12.5)	13 (4.06)
	51~	643	168 (26.13)	76 (11.82)	12 (1.87)	250	29 (11.6)	36 (14.4)	14 (5.6)
	61~	335	91 (27.16)	52 (15.52)	12 (3.58)	147	16 (10.88)	25 (17.01)	13 (8.84)
	≥ 71	300	57 (19.0)	42 (14.00)	7 (2.33)	157	11 (7.01)	23 (14.65)	6 (3.82)
	Total	4446	1093 (24.58)	705 (15.86)	64 (1.44)	1790	199 (11.12)	341 (19.05)	62 (3.46)

differences between men and women (x^2 = 1.377, P > 0.05).

Detailed data were shown in **Table 3**. In 6077 cases of 2005, there were 313 cases with multiple-insect infection, accounting for 5.15%, including 225 males (5.18%, 225/4347) and 88 females (5.09%, 88/1730); and there was no statistically significant difference between male and female (x^2 = 1.377, P > 0.05). There were 298 cases (95.2%), 14 cases (4.47%) and 1 case (0.32%) with two kinds, three kinds and four kinds of parasitic infections respectively. The infection of Liver fluke + B. hominis was the most, accounting for 54.95% (172 cases), followed by 47 cases of the infection of Liver fluke + hookworm (15.02%) and 36 cases of the infection of hookworm + B. hominis (11.50%).

In the detected 6236 cases in 2013, there were 184 cases with multiple-insect infection, accounting for 2.95%, including 142 males (3.19%, 142/4446) and 42 females (2.35 %, 42/1790); and there was no statistically significant difference between male and female (P > 0.05); the infection rates were lower than that in 2005 and the difference was statistically significant (P < 0.01). The situation of multiple-insect infection in 2013 was simpler than that in 2005, without four kinds of parasitic infections and only with three cases of three kinds of infections. The infection of Liver fluke + B. hominis infection was still the most, accounting for 77.17% (142 cases), which was significantly higher than that in 2005 (P > 0.01), followed by 25 cases of the infection of Liver fluke + hookworm (13.81%) and 12 cases of the infection of hookworm + B. hominis (6.63%).

The age distribution of main intestinal parasitic infections

It was shown in **Table 4**. For male, the age group of 41~ had the highest infection rate of clonorchissinensis in 2005 (x^2 = 5.734, P < 0.05), and the age groups of 31~ and 41~ had the highest infection rate of clonorchissinensis in 2013 (x^2 = 8.908, P < 0.01); for female, both in 2005 and 2013, the age groups of 21~, 31~, 41~ and 51~ had the highest infection rate of clonorchissinensis (x^2 = 6.508, 5.145, P < 0.05). There was no difference in male infection rate of B. hominis in 2005 (x^2 = 10.134, P > 0.05); in 2013, the age group of 0~ had the highest infection rate (x^2 = 3.825, P < 0.05); for female, it was the highest in the age groups of 11~, 21~ and 31~ in 2005 (x^2 = 10.459, P < 0.01), 0~ and 11~ in 2013 (x^2 = 53.669, P < 0.01). For Hookworm infection in male, the highest infection rate was found in the age group of 11~ 21~

and 61~ in 2005 (x^2 = 4.547, P < 0.05), 61~ and ≥ 71~ in 2013 (x^2 = 4.843, P < 0.05); for female, the highest infection rate was found in the age groups of 51~ and 61~ both in 2005 and 2013 (x^2 = 5.709, 5.958, P < 0.05).

Discussion

Clonorchissinensis, which is also known as liver fluke with small eggs, was easily missed in the stool. The detection rate of acid-ether centrifugation method is superior to other methods [2]. Probably because hydrochloric acid and feces interact with each other, so that part of the stool will dissolve, which could make the faeces release from eggs. The law can also be applied in checking other intestinal worms and protozoa cysts. Guangxi, as geographical location and relatively backward economic development, is an area with a high incidence of parasitic infection. But in recent years, Guangxi has made great progress in all aspects. People's living standard has been greatly improved, and parasite infection status will be affected and changed accordingly. The survey showed that nine kinds of intestinal parasites were found in 2005, but these remain exist in 2013 without reduction, and Brinell ginger fluke were added. Although the infections rate of fluke B. hominis, hookworm, whipworm and roundworm in 2013 was lower than that in 2005, the overall infection rate was still as high as 37.08 percent. Liver fluke and B. hominis were still the highest prevalence of insect species. In the three hook, whip and roundworm geohelminthes, in addition to that hookworm infection was relatively higher, the whipworm and roundworm infection was very low. The overall infection rate of three geohelminthes was 5.78% in 2005 and dropped to 2.41% (x^2 = 88.713, P < 0.01), indicating that after years of prevention in Guangxi, Geohelminthes has been controlled gradually, and will remain in a low level in the future [3]. 2004 National parasites census showed that Guangxi was a fluke popular hardest hit, with an average rate of 9.75% and ranked second [1]. Eating "sashimi" is the main way that infected with liver fluke in endemic areas with Guangxi people. People in endemic areas were addictive in eating "sashimi". As living standards improve, the habit of eating "sashimi" was not only changed in local, but also as a fashion to promote, which made eating "sashimi" further expand in the crowd and caused liver fluke infection rate rising in recent years [3, 4]. The survey showed that attenders over 21 years with liver fluke were in high infection rate, and the age span was large; But the data showed that in 2013 the liver fluke infection rate was lower than that in 2005, and did not show a corresponding rise, which may be related to that the surrounding city of Nanning City, county hospitals paid more attention to diagnosis and treatment of liver fluke disease. In addition to universal health insurance, it was more convenient for patients to get appropriate treatment in the local [5, 6]. In 2013 hookworm infection was concentrated in the older age groups who were over 51 years. This change may be related to that more young Chinese rural migrated to work, and the elderly were left for farming lifestyle. B. hominis has long been considered as non-pathogenic, but recent studies and epidemiological investigations showed that the pest had the opportunity to pathogenicity, while most were asymptomatic parasites. Major clinical manifestations in symptomatic patients were of different degrees of diarrhea. They were paid more attention for that intestinal protozoa was a common cause of diarrhea [7-9]. The pest infection rate was high or low in different places. In coastal areas of Guangxi, the census showed that the infection rate of B. hominis was 26.35% in local residents, without gender difference. The highest infection rate was 0-9 year's old children, which was up to 34.79% [10]. The analysis showed that attenders with B. hominis infection in 2013 was at same level with that in 2005. There were differences between the two genders, and more women were infected than men. There was no significant difference in infection rate with different ages in 2005, and the infection rate of 0-40-year-olds group was relatively higher. However, it was concentrate highlighted in the 0 to 20 years old group, especially the 0-10 year-olds group. This may be due to a substantial increase in censorship in 2013, at the same time it also meant that doctors also paid more attention to children infected with B. hominis.

In short, from the analytical results we can see the status of attenders with intestinal parasite infection in 2013, compared with that eight years ago, infected insect species remain nine kinds and Brinell ginger flukes were added; Despite overall infection rate were declined, it was still very high; Buggy infection rate decreased significantly; Male infection rate

was still higher than that in female, and liver fluke infection rate was still the highest male insect species, while it was hominis in women, at the same time both of the two infected insect were at a higher level; Geohelminthes had dropped to a lower level. Because it is difficult to abandon the local habit of eating "sashimi" and cannot completely get rid of lacking of B. hominis drugs in the current, we estimated that liver fluke and B. hominis will maintain a high infection rate for a long period of time. Prevention should be focused. For the attenders with the experience of "sashimi", doctor should routinely troubleshoot the infection of Liver fluke; for patients with recurrent and unexplained diarrhea, the troubleshooting of B. hominis infection should be considered. Because stool examination was not a routine examination for pinworm infection, the statistical results showed that the infection rate (0.05%) was very low or even undetectable, which did not reflect the actual situation. Recent epidemiological survey data showed that pinworm infection rates were 5.5% and 45.9% in Guangxi urban and rural children under 12 years [11]. Infection rate was not low, therefore as the suspected pinworm-infected attenders, cellophane tape method was recommended to check eggs or get the adults to confirm. More attention should be paid to that there is an upward trend in 2013 for Brinell ginger fluke. In addition, the survey showed that Stercoralis, Entamoebahistolytica, Giardia lamblia and Brinell ginger fluke were detected each year, however, very few numbers of cases were detected. It was noteworthy that these patients were uncommon and maybe overlooked, leading to misdiagnosis.

Acknowledgements

This work was supported by the National Natural Science Foundation of China (No. 81360256) and the project of outstanding young teachers' training in higher education institutions of Guangxi.

Disclosure of conflict of interest

None.

Address correspondence to: Drs. Huan-Huan Shi and Yan-Wen Li, Department of Parasitology, Guangxi Medical University, 22 Shuangyong Road Nanning, Guangxi, China. Tel: +86+0771-5322863; Fax: +86+0771-5359201; E-mail: shihuanhuan2@126.com (HHS); liyanwen1222@163.com (YWL)

References

[1] Coordinating Office of the National Survey on the Important Human Parasitic Diseases. A national survey on current status of the important parasitic diseases in human population. Chin J Parasitol Parasit Dis 2005; 23: 332-339.

[2] Liu DY, Zhang ZK and Yu LB. Detect the effect of Clonorchissinensis eggs with hydrochloric acid-aether sedimentation. Chin J Parasitol Parasit Dis 1994; 12: 75.

[3] Zhang XJ, Yang FF, Lin R, Wang G, Li XM and Ou YY. Survey on current status of parasites infection in surrounding counties of Nanning, Guangxi, China. Journal of Guangxi Medical University 2011; 28: 650-652.

[4] Mo TW, Wu MS, Wu S and Huang YM. Epidemiological investigation on Clonorchiasissinensis in Sanjiang County, Guangxi. Int J Med Parasit Dis 2013; 40: 196-198.

[5] Lian SD, Wu YR and Pan YL. Analysis on 2175 admitted cases of Clonorchiasissinensis Guigang City. Chin J Parasitol Parasit Dis 2008; 26: 374-375.

[6] Chen YX. Analysis of the prevalence of Clonorchiasissinensis in outpatients and inpatients in Hengxian Guangxi. Journal of Pathogen Biology; 6: 1-2011.

[7] Parija SC, Jeremiah S. Blastocystis: Taxonomy, biology and virulence. Trop Parasitol 2013; 3: 17-25.

[8] Jin QX, Yu KM, Tang LF, Tian CL and Lu ZC. Investigation of infectious status of Blastocystishominis in l354 outpatients. China Tropical Medicine 2005; 5: 1469-1471.

[9] Xie ZJ, Zhang RQ, Huang WF, Liao YG and Su SL. Blastocystishominis infection status and clinical research of adults with chronic diarrhea in Ganzhou district. J South Med Univ 2008; 28: 1035-1036.

[10] Yan Y, Liu XQ, Tang LL, Shi HH, Liu T, Wang G, Zhang XJ and He SS. Investigation of human infection with Blastocystishominis in the southern coastal areas of Guangxi Province. Journal of Pathogen Biology 2011; 6: 142-143.

[11] Chen YD, Wang JJ, Zhu HH, Zhu TJ, Zang W, Qian MB, Li HM, Zhou CH and Wang GF. Enterobiusvermicularis infection status among children in 9 provinces/Autonomous regions/Municipalities of China. Chin J Parasitol Parasit Dis 2013; 31: 251-255.