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VALIDITY OF SELECTED CLINICAL SIGNS AND SYMPTOMS IN DIAGNOSIS OF *Schistosoma mansoni* INFECTION

Maria Fernanda F. de LIMA E COSTA (1), Roberto S. ROCHA (2), Daniel COLLEY (3), Giovanni GAZZINELLI (2) & Naftale KATZ (2)

SUMMARY

Sensitivity, specificity and positive predictive values of selected clinical signs and symptoms in the diagnosis of **Schistosoma mansoni** infection were evaluated in 403 individuals (69% of inhabitants over 1 year of age) in an endemic area in Brazil (Divino). Highest sensitivity (13%) was found for blood in stools. Specificity over 90% was found for blood in stools, palpable liver with normal consistency and palpable hardened liver at middle clavicular (MCL) or middle sternal lines (MSL). Hardened liver at MSL (83%) or MCL (75%), and blood in stools (78%) presented higher positive predictive values for **S. mansoni** infection, while palpable liver with normal consistency at MCL (45%) or MSL (48%) presented smaller values. Enlarged liver without specification of its consistency has been traditionally used as an indicator of the infection in areas where malaria or Kalazar are not endemic. Our results demonstrate that the probability that a person with blood in stools or hardened palpable liver is infected is higher than among those with palpable liver with normal consistency.

KEY WORDS: Schistosoma mansoni infection; Morbidity; Validity of clinical signs and symptoms; Cross sectional study.

INTRODUCTION

Knowledge of clinical signs and symptoms associated with **Schistosoma mansoni** infection in endemic areas can be useful in the presumptive diagnosis of this infection. Selected clinical signs and symptoms could be used by primary care workers in making early diagnostic of the infection or as a basis for suggesting further diagnostic tests in endemic areas[18].

Studies on validity of clinical signs and symptoms in the diagnosis of **S. mansoni** infection are few. Sensitivity, specificity and predic-

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(1) Departamento de Medicina Preventiva e Social, Grupo de Pesquisas em Epidemiologia, Universidade Federal de Minas Gerais, Brasil.
(2) Centro de Pesquisas René Rachou, Fundação Oswaldo Cruz, FIOCRUZ, Brasil.
(3) Vanderbilt University School of Medicine, USA.
Address for correspondence: Dra. Maria Fernanda F. de Lima e Costa. Departamento de Medicina Preventiva e Social, Universidade Federal de Minas Gerais. Av. Alfredo Balena, 190. CEP 30130 Belo Horizonte, Minas Gerais, Brazil.

tive values of diarrhea, blood in stool and abdominal pain were evaluated in an endemic area for schistosomiasis mansoni in Zambian. Diarrhea in the last two weeks was the most sensitive symptom and blood in stool had the highest specificity and positve predictive values[18]. In an endemic area in Brazil, several gastrointestinal complaints and liver characteristics were evaluated. Hardened liver had the highest sensitivity, specificity and positive predictive values for diagnosis of **S. mansoni** infection[15].

As part of an investigation on the epidemiology of schistosomiasis mansoni in an endemic area in Brazil (Divino), we investigated the validity of selected clinical signs and symptoms (gastrointestinal complaints, liver and spleen characteristics) in the diagnosis of **S. mansoni** infection.

MATERIALS AND METHODS

Study area

Divino is a village with 611 inhabitants, situated in the State of Minas Gerais in Brazil. Malaria or visceral leishmaniasis have never been reported in the area, and the intermediate host in the transmission of schistosomiasis is **Biomphalaria glabrata**. Further details are in LIMA E COSTA **et al**[12].

Census and stool examination

A complete census of the village was conducted in March and April, 1986. All inhabitants were provided with an identifiable container for collecting the stool samples. Two slides of a stool sample of each individual were examined by the Kato-Katz method[9], being all examinations done by the same technician.

Clinical interview and physical examination

A standard questionnaire was used to obtain information about abdominal pain, diarrhea, and blood in stools during the previous 30 days, and about ascites, haemathemesis, splenectomy, and treatment with schistosomicides during the lifetime.

Individuals were examined lying on their back and on their right side for liver and spleen enlargement. Liver or spleen were considered palpable when detected immediately under the costal margin, with the breath held. When palpable, measures of liver sizes were made in centimeters at middle clavicular (right lobe) and middle sternal (left lobe) lines during quiet breathing.

Clinical interviews and physical examinations were performed before knowledge of the individuals' laboratory results, and all examinations were done by a single physician. Only individuals over 1 year of age were examined.

Cases were defined as individuals with **S. mansoni** eggs, and controls were those without eggs in the stools.

Analysis of data

The probability of infected individuals having a symptom present (sensitivity), and the probability of non infected individuals having a symptom absent (specificity) were calculated. The probability that a person with a symptom is infected (positive predictive values) was calculated for the prevalence of **S. mansoni** infection in the case control series, and for theoretical levels of prevalence (10, 20, 30, 40, 50, 60 and 70%, respectively)[3].

To assess statistical significance of associations (Type I error), Wilcoxon rank test (for medians), overall chi-square, Fisher's exact test, or chi-square for linear trend (for proportions) were used[3, 8].

RESULTS

Stool examinations were performed in 528 / 611 (86.4%) inhabitants from Divino. Clinical interviews and physical examinations were performed in 403 individuals (69.2% of those over 1 year of age). Prevalence of **S. mansoni** infection was 37.5% and geometric mean of eggs in those infected was 139.8 ± 3.5 epg (only individuals over 1 year of age eliminated **S. mansoni** eggs in stools).

Table 1 shows the comparison of selected clinical signs and symptoms among cases and controls. Blood in stools, palpable liver at middle clavicular (MCL) or middle sternal (MSL) lines

and median liver sizes at MCL or MSL were significantly ($p < 0.05$) associated with **S. mansoni** infection. Previous treatment with schistosomicides was similar in both groups. There were no cases of haematemesis, ascites or antecedents of splenectomy in the study area.

Table 2 shows sensitivity, specificity and predictive values for **S. mansoni** infection. Highest sensitivity (12.7%) was found for blood in stools. Specificity over 90% was found for blood in stools, palpable liver with normal consistency at MCL or MSL, and palpable hardened liver at MCL or MSL. Blood in stools (77.8%), and palpable hardened liver at MCL (75.0%) or MSL (83.3%) had higher positive predictive values for **S. mansoni** infection.

Table 3 shows an example of calculations for results in table 2 and figure 1.

Figure 1 shows positive predictive values of selected symptoms calculated for theoretical levels of prevalence of **S. mansoni** infection. Hardened liver at MSL, blood in stools and hardened liver at MCL presented higher values, while palpable liver with normal consistency at MCL or MSL presented smaller values.

TABLE 1

Schistosoma mansoni infection, according to selected clinical signs and symptoms, and previous treatment with schistosomicides.

Symptoms	Infected (n = 166)%	Control (n = 237)%	p value
Abdominal pain			
No	(109)65.7	(146)61.6	
Yes	(57)34.3	(91)38.4	p" = 0.467
Blood in stools			
No	(145)87.3	(231)97.5	
Yes	(21)12.7	(6) 2.5	p" < 0.001
Diarrhea			
No	(130)78.3	(183)77.2	
Yes	(36)21.7	(54)22.8	p" = 0.890
Liver at MCL			
Not palpable	(143)86.2	(217)91.6	
Palpable with normal consistency	(14) 8.4	(17) 7.2	
Palpable hardened	(9) 5.4	(3) 1.3	p" = 0.025
Median size in cm if palpable (range)	3(2-4)	2(1-3)	p"" = 0.029
Liver at MSL			
Not palpable	(144)86.8	(222)93.7	
Palpable with normal consistency	(12) 7.2	(13) 5.5	
Palpable hardened	(10) 6.0	(2) 0.8	p"' = 0.002
Median size in cm if palpable (range)	5(3-8)	3(2-5)	p"" = 0.001
Spleen			
Not palpable	(161)97.0	(236)99.6	
Palpable	(5) 3.0	(1) 0.4	p"" = 0.086
Previous treatment			
No	(128)77.1	(182)76.8	
Yes	(38)22.9	(55)23.2	p" = 0.963

Infected: presence of **S. mansoni eggs in stools**
Control : **absence of S. mansoni** eggs in stools
P" :p value (continuity adjusted chi-square)
P"' :p value (chi-square for trend)
P"" : p value (Fisher's exact test)
P""' :Wilcoxon rank test
MCL :middle clavicular line; MSL: middle sternal line

TABLE 2

Sensitivity, specificity and predictive values for clinical signs and symptoms significantly associated with **S. mansoni** infection.

Symptoms	Sensitivity	Specificity	Predictive values	
			Positive	Negative
	%	%	%	%
Blood in stools	12.7	97.5	75.0	64.5
Palpable liver hardened				
at MCL	5.4	98.7	72.4	63.0
at MSL	6.0	99.2	82.0	63.3
Palpable liver with normal consistency				
at MCL	8.4	92.8	41.6	62.3
at MSL	7.2	94.5	44.2	62.5

MCL: middle clavicular line
MSL: middle sternal line

TABLE 3

Example of calculations for sensitivity, specificity, and predictive values.

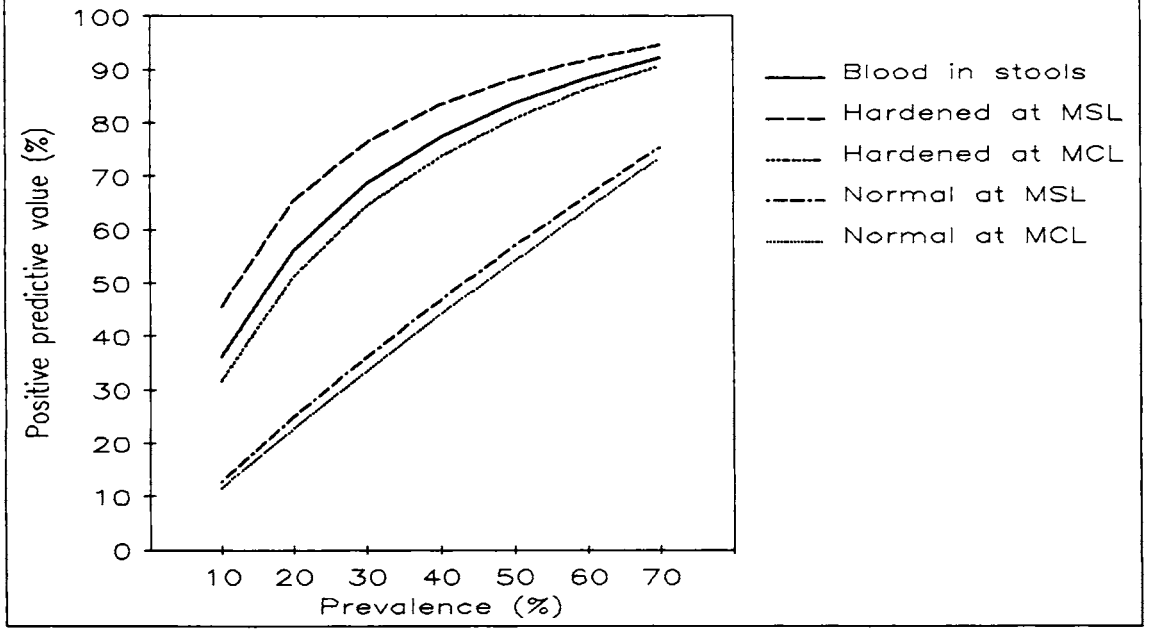
		Infected	Controls	Total
Blood in stools	Yes	21 (a)	6 (b)	(a+b)
	No	145 (c)	231 (d)	(c + d)
Total		166 (a+c)	237 (b+d)	(a+b+c+d)

Sensitivity (SN) = a/a+c = 21/166 = 0.126 (12.6%)
Specificity (SP) = d/b+d = 231/237 = 0.975 (97.5%)
Prevalence (P) = a+c/a+b+c+d
Positive predictive value =
(SN) (P) / (SN) (P) + (1-SP) (1-P) = 0.750 (75.0%)

DISCUSSION

A consistent association between blood in stools and **S. mansoni** infection has been obser-

Figure 1
Positive predictive values of selected symptoms for S.mansoni infection, according to theoretical levels of prevalence



ved in endemic areas for schistosomiasis in different countries. Diarrhea and abdominal pain were found to be associated with the infection in some areas but not in others. Consistency of liver has been specified in few studies, and the association between enlargement of liver and/or spleen and **S. mansoni** infection varies in different endemic areas; in some areas, hepatomegaly or splenomegaly were found to be associated with the infection, while in others no association was found[1, 2, 4, 5, 6, 7, 10, 13, 15, 16, 17, 18, 19].

Gastrointestinal complaints, such as diarrhea and abdominal pain, found to be associated with **S. mansoni** infection might depend on the existence of other gastrointestinal infections in the investigated area. Spleen and/or liver impairment are part of **S. mansoni** pathogenesis, and lack of association between the infection and hepatomegaly or splenomegaly are due to three main reasons: (1) the existence of other causes of hepatomegaly and/or splenomegaly in the area (such as malaria or visceral leishmaniasis), (2) large number of individuals previously treated with schistosomicides among the controls (in this case, hepatomegaly or splenomegaly might be sequelae of previous **S. mansoni** infection), and (3) low morbidity due to **S. mansoni** infection (small number of individuals with hepatomegaly or splenomegaly provides insufficient power for statistical analysis). Other potential source of variations in controlled studies on the morbidity of schistosomiasis were recently listed by PROIETTI & ANTUNES[15].

In Divino, visceral leishmaniasis and malaria were not endemic, and previous treatment with schistosomicides was similary distributed between cases and controls. Some precautions were taken to restrict possibility of inaccuracies: (a) 69% of inhabitants over 1 year of age were submitted to clinical interviews and physical examinations, being this proportion similarly distributed between those who eliminated or not eggs in stools; (b) definition of cases and controls was based on the same criteria; (c) clinical interviews and physical examinations were double blind; (d) period of recall for diarrhea, blood in stools and abdominal pain was restricted to the last 30 days; (e) stool examinations were done

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by the same technician, using the same technique; (f) all interviews and physical examinations were done by the same physician.

Enlarged liver without specification of its consistency has been traditionally used as an indicator of the infection in areas where malaria or visceral leishmaniasis are not endemic[14]. In this study, palpable hardened liver at middle clavicular or middle sternal lines and blood in stools had high positive predictive values for **S. mansoni** infection. These symptoms presented higher positive predictive values than palpable liver with normal consistency, indicating that consistency of liver and blood in stools must be considered in the presumptive diagnosis of **S. mansoni** infection in endemic areas.

RESUMO

Validade de alguns sinais e sintomas no diagnóstico da infecção pelo Schistosoma mansoni.

Foi examinada a sensibilidade, a especificidade e os valores preditivos positivos de alguns sinais e sintomas para o diagnóstico presumível da infecção pelo **Schistosoma mansoni** em uma área edêmica de Minas Gerais (Divino): 403 indivíduos (69% dos habitantes com mais de 1 ano de idade) participaram da investigação. Maior sensibilidade foi observada para sangue nas fezes (13%). Especificidades acima de 90% foram encontradas para sangue nas fezes, e para fígado palpável com consistência normal ou aumentada nas linhas hemi-clavicular (LHC) e médio-esternal (LME). Os maiores valores preditivos positivos para a infecção foram observados para fígado palpável com consistência aumentada na LME (83%) ou LHC (75%) e presença de sangue nas fezes (78%); os menores valores foram para fígado papável com consistência normal na LME (48%) e LHC (45%). A presença de fígado palpável sem especificação da sua consistência tem sido tradicionalmente utilizada como um indicador da infecção em áreas onde a malária ou o Kalazar não são endêmicos. Nossos resultados mostram que a probabilidade de indivíduos com sangue nas fezes ou com aumento da consistência do fígado apresentarem a infecção é maior do que entre aqueles com fígado palpável mas com a consistência normal.

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REFERENCES

1. CLINE, B. L.; RIMZO, W. T.; HIATT, R. S.; KNIGHT, W. B. & BERRIOS-DURAN, L. S. — Morbidity from **Schistosoma mansoni** in a Puerto Rican community: a population-based study. **Amer. J. trop. Med. Hyg., 26**: 109-117, 1977.

2. COOK, J. A.; BAKER, S. T.; WARREN, K. S. & JORDAN, P. — A controlled study of morbidity from schistosomiasis mansoni in St. Lucian children, based on quantitative egg excretion. **Amer. J. trop. Med. Hyg., 23**: 625-633, 1974.

3. FLEISS, J. L. — **Statistical methods for rates and proportions**. 2nd. ed. New York, John Wiley & Sons, 1981.

4. GUIMARÃES, M. D. C. — **A schistosomiasis mansoni clinical-epidemiologic study in a small Brazilian Community.** Jerusalem, Hebrew University, 1982. (Masters' degree thesis).

5. GUIMARÃES, M. D. C.; LIMA E COSTA, M. F. F.; LIMA, L. B. & MOREIRA, M. A. — Estudo clínico-epidemiológico da esquistossomose mansoni em escolares da Ilha, Município de Arcos, MG (Brasil) 1983. **Rev. Saúde públ. (S. Paulo), 19**: 8-17, 1985.

6. HIATT, R. S. — Morbidity from **Schistosoma mansoni** infections: an epidemiologic study based on quantitative analysis of egg excretion in two highlands Ethiopian villages. **Amer. J. trop. Med. Hyg., 25**: 808-817, 1976.

7. HIATT, R. S. & GEBRIN-MEDHIN, M. — Morbidity from **Schistosoma mansoni** infections: an epidemiologic study based on quantitative analysis of egg excretion in Ethiopian children. **Amer. J. trop. Med. Hyg., 26**: 473-481, 1977.

8. HOLLANDER, M. & WOLFE, D. A. — **Nonparametric statistical methods.** New York, John Wiley & Sons, 1973.

9. KATZ, N.; CHAVES, A. & PELLEGRINO, J. — A simple device for quantitative stool thick-smear technique in schistosomiasis mansoni. **Rev. Inst. Med. trop. S. Paulo, 14**: 397-400, 1972.

10. LEHMAN Jr., J. S.; MOTT, K. E.; MORROW Jr., R. H.; MUNIZ, T. M. & BOYER, M. H. — The intensity and effects of infection with **Schistosoma mansoni** in a rural community in Northeast Brazil. **Amer. J. trop. Med. Hyg., 25**: 285-294, 1976.

11. LIMA E COSTA, M. F. F.; ROCHA, R. S. & KATZ, N. — Morbidade da esquistossomose e sua relação com a contagem de ovos de Schistosoma mansoni em uma zona hiperendêmica do Estado de Minas Gerais. **Rev. Inst. Med. trop. S. Paulo, 27**: 66-75, 1985.

LIMA E COSTA, M. F. F. de; ROCHA, R. S.; COLLEY, D.; GAZZINELLI, G. & KATZ, N. — Validity of selected clinical signs and symptoms in diagnosis of **Schistosoma mansoni** infection. **Rev. Inst. Med. trop. S. Paulo, 33(1)**: 12-17, 1991.

12. LIMA E COSTA, M. F. F.; ROCHA, R. S.; LEITE, M. L. C.; CARNEIRO, R. G.; COLLEY, D.; GAZZINELLI, G. & KATZ, N. — A multivariate analysis of socio-demographic factors, water contact patterns and **Schistosoma mansoni** infection in an endemic area in Brazil. **Rev. Inst. Med. trop. S. Paulo, 33**: 58-63, 1991.

13. LOUREIRO, S. — **Variáveis epidemiológicas na esquistossomose mansoni.** Salvador, 1973. (Tese de concurso — Universidade Federal da Bahia).

14. PESSOA, S. B. & BARROS, P. R. — Notas sobre a epidemiologia da esquistossomose mansônica no Estado do Sergipe. **Rev. Med. Cirurg. S. Paulo, 13**: 17-24, 1953.

15. PROIETTI, F. & ANTUNES, C. M. F. — Sensitivity, specificity and positive predictive values of selected clinical signs and symptoms associated with schistosomiasis mansoni. **Int. J. Epidem., 18**: 680-683, 1989.

16. SIONGOK, T. K. A.; MAHMOUD, A. A. F.; OUMA, J. H.; WARREN, K. S.; MULLER, A. S.; HANDA, A. K. & HOUSER, H. B. — Morbidity in schistosomiasis mansoni in relation to intensity of infection: study of a community in Machakos, Kenya. **Amer. J. trop. Med. Hyg., 25**: 273-284, 1976.

17. SMITH, D. H.; WARREN, K. S. & MAHMOUD, A. A. F. — Morbidity in schistosomiasis mansoni in relation to intensity of infection: study in a community in Kisumi, Kenya. **Amer. J. trop. med. Hyg., 28**: 220-229, 1979.

18. SUKWA, T. Y.; BULSARA, M. K. & WURAPA, F. K. — Evaluation of selected symptoms in the diagnosis of **Schistosoma mansoni** infection. **Trop. geogr. Med., 37**: 295-297, 1985.

19. SUKWA, T. Y.; BULSARA, M. K. & WURAPA, F. K. — The relationship between morbidity and intensity of **Schistosoma mansoni** infection in a rural Zambian community. **Int. J. Epidem., 15**: 248-251, 1986.

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