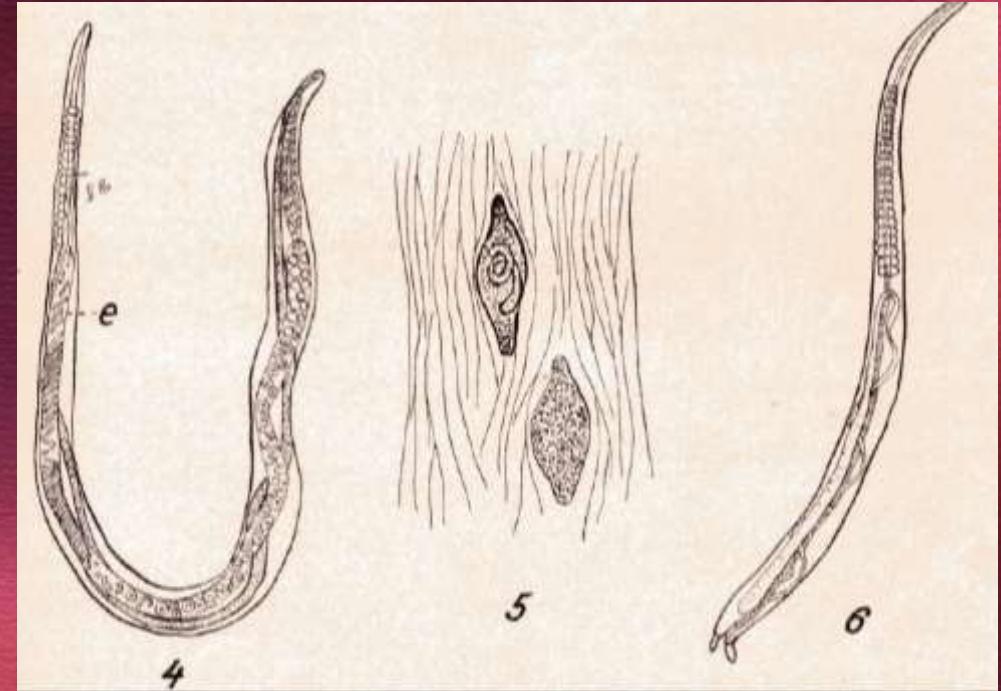


Triquinosis

Prof. Alfonso J. Rodríguez-Morales
Parasitología Grupos 4 y 5
Semestre I-2015



Definición de triquinosis (ó triquinelosis)

- Es una enfermedad infecciosa, parasitaria, causada por parásitos del género *Trichinella*, que puede infectar una amplia gama de hospedadores mamíferos (incluyendo al ser humano), también a aves e incluso reptiles.
- El ser humano adquiere la infección al ingerir carne (tejido muscular) crudo o mal cocido de animales domésticos ó salvajes.
- No es una geohelmintiasis.



720. *Crocodylus porosus*, el cocodrilo de los estuarios

Hay varias especies de reptiles acuáticos portadoras de *Trichinella*. Se ha identificado la presencia de anticuerpos frente a un nuevo parásito (*Trichinella papuiae*) descrito en el cocodrilo de agua salada (*Crocodylus porosus*) en casi la tercera parte de las personas (las dos terceras partes varones) que residen en una zona concreta de la parte sudoccidental de Papúa Nueva Guinea. El origen de la infección en el ser humano es el cerdo salvaje. En esta misma zona se han detectado larvas de este nematodo en casi el 9% de los cerdos salvajes, que son cazados de manera intensiva y a menudo consumidos crudos o cocinados de manera insuficiente. Los cerdos domésticos de esta zona también han presentado la infección. Otro nematodo parasitario de este género, *Trichinella zimbabwensis*, se ha observado en el 40% de los cocodrilos del Nilo (*Crocodylus niloticus*) criados en granjas. Este parásito africano también se ha observado en diversos mamíferos salvajes, a los que infecta con facilidad. Dado que la cría de cocodrilos en granjas es una actividad cada vez más frecuente, es probable que en el futuro estos parásitos se puedan identificar en personas con evidencia clínica de triquinosis, a menos que se adopten precauciones como la detección de las larvas en los tejidos de los reptiles o la congelación de la carne. En los programas de cría nacionales aplicados en 1998 se señalaba que en aquel momento había ya 30 países en los que se realizaba esta actividad, con un volumen de negocio equivalente a 60 millones de dólares estadounidenses.



Atlas de medicina tropical y
parasitología (6a ed.) Wallace
Peters, et al. ISBN: 978-84-8086-
283-7, 2008.

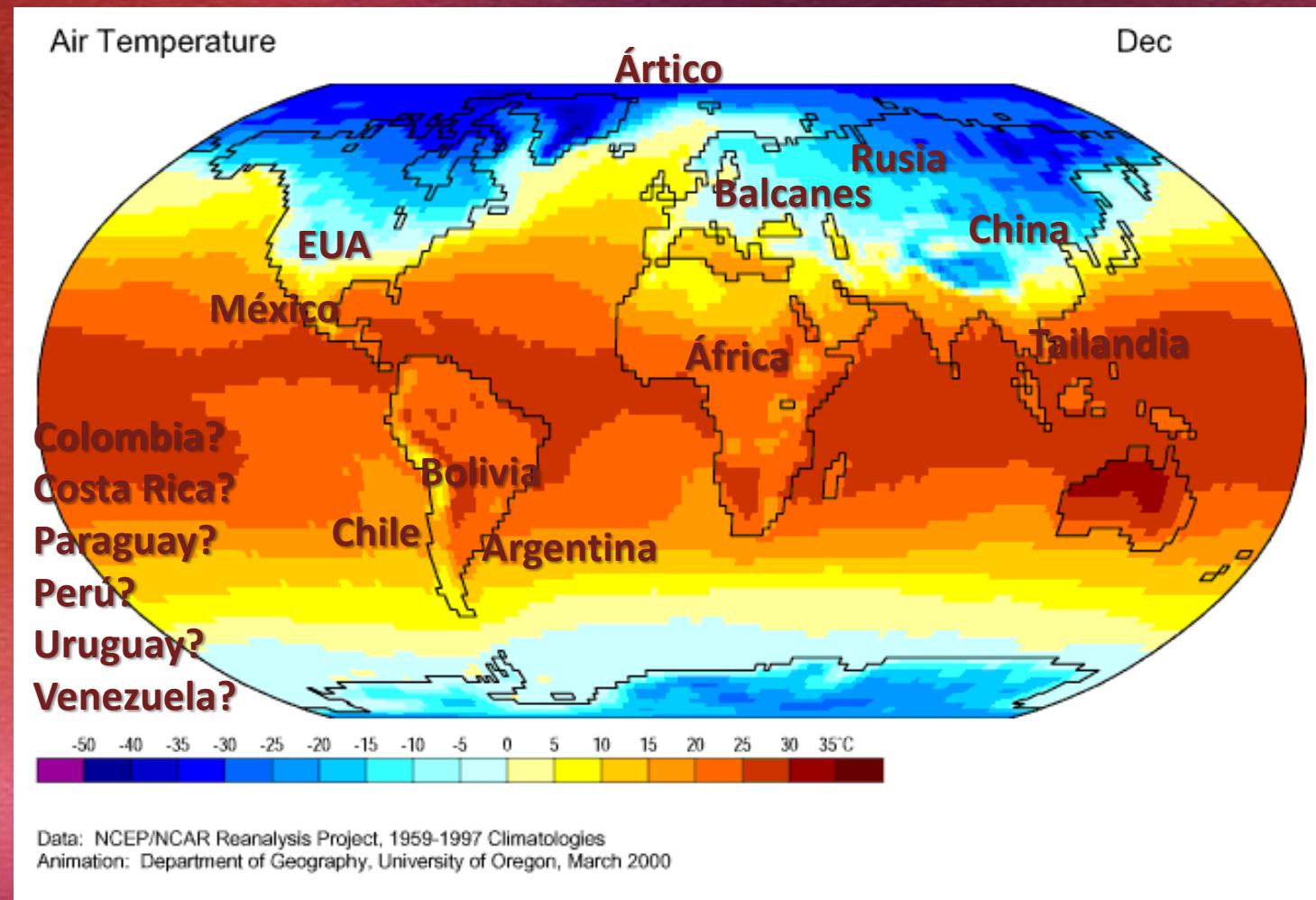
Iquitos, Perú
(selva amazónica).
Foto: A. J. Rodríguez-Morales,
2009.

Classification of Selected Pathogenic Nematodes,

Subclass	Order	Superfamily	Species
Aphasmidia (Adenophorea)	Enoplida	Trichuroidea	<i>Trichinella spiralis</i>
			<i>Trichuris trichiura</i>
			<i>Capillaria philippinensis</i>
			<i>Capillaria hepatica</i>
Phasmidia (Secernentea)	Rhabditida	Rhabdiasoidea	<i>Strongyloides stercoralis</i>
			<i>Strongyloides fulleborni</i>
	Strongylida	Ancylostomatoidea	<i>Ancylostoma duodenale</i>
			<i>Ancylostoma braziliense</i>
			<i>Ancylostoma ceylanicum</i>
			<i>Necator americanus</i>
			<i>Trichostrongyloidea</i>
	Oxyurida	Metastrongyloidea	<i>Trichostrongylus orientalis</i>
			<i>Angiostrongylus cantonensis</i>
			<i>Angiostrongylus costaricensis</i>
	Oxyurida	Oxyuroidea	<i>Enterobius vermicularis</i>

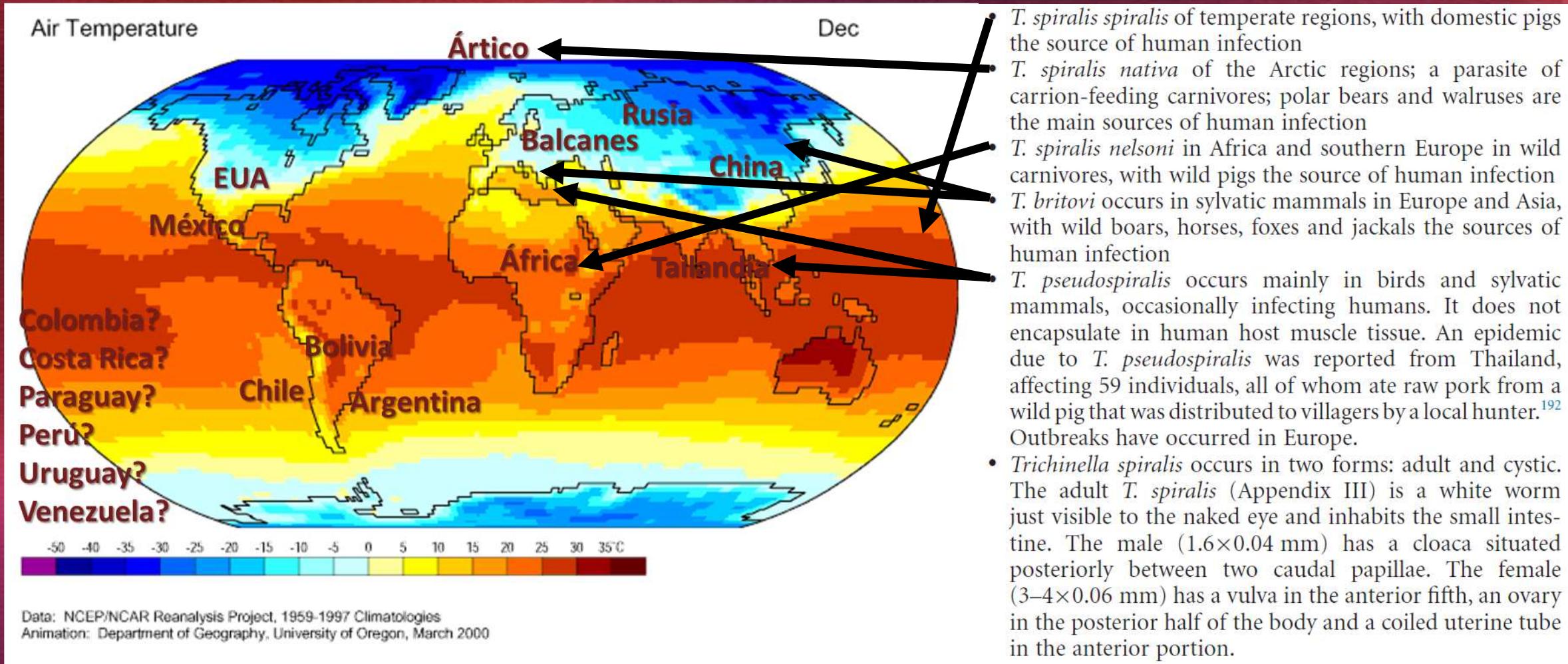
Distribución geográfica

Documentada en al menos 55 países del mundo



Distribución geográfica

Documentada en al menos 55 países del mundo



Epidemiología - Latinoamérica

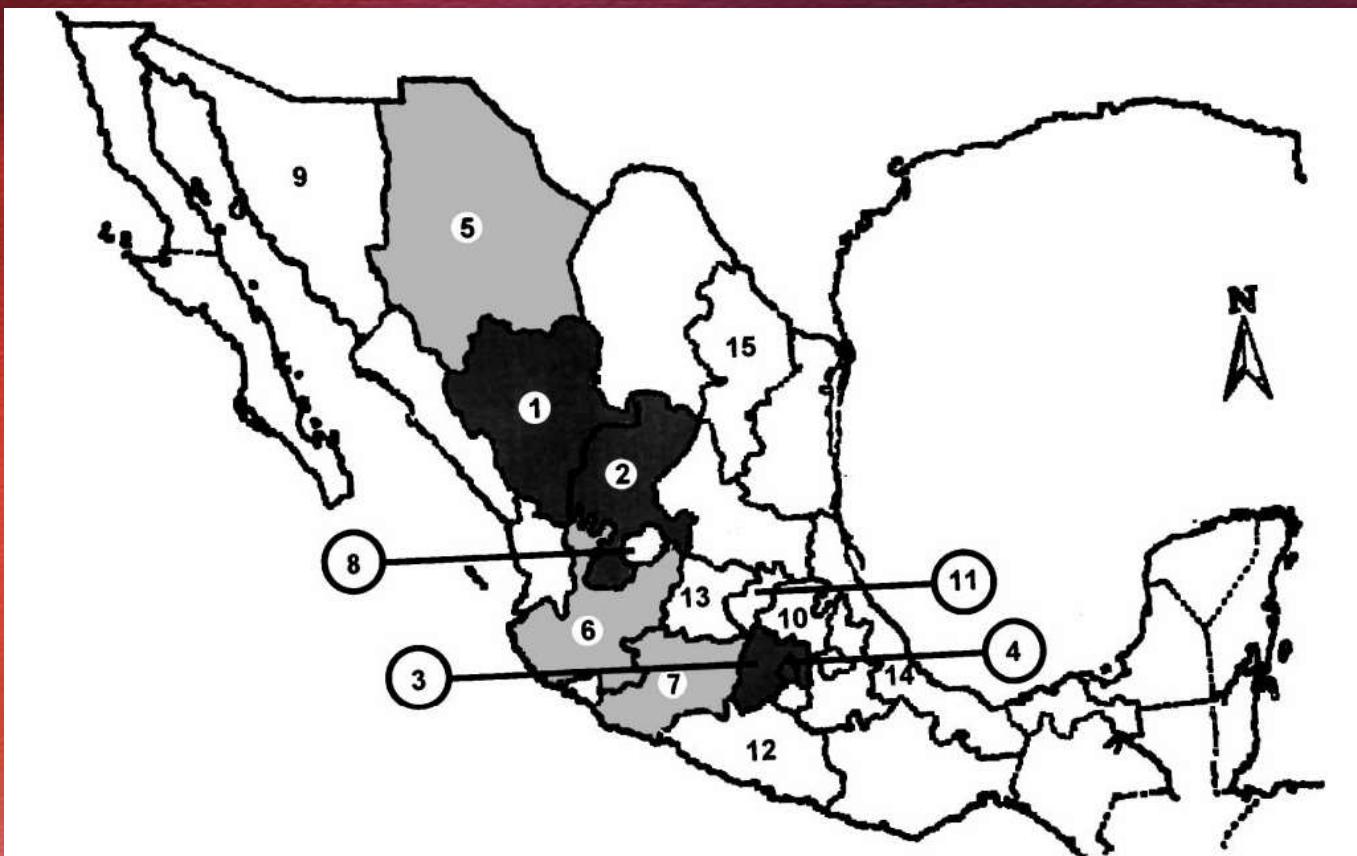


Fig. 1. States of Mexico in which outbreaks of human or animal trichinellosis have been reported. States of high incidence (■) include: the States of Durango (1), Zacatecas (2), State of Mexico (3), Mexico City (4); states with medium incidence (▨) include: Chihuahua (5), Jalisco (6), Michoacan (7); states with low incidence (□) include: Aguascalientes (8), Sonora (9), Hidalgo (10), Queretaro (11), Guerrero (12), Guanajuato (13), Veracruz (14) and Nuevo Leon (15).

Epidemiología Latinoamérica



Ortega-Pierres MG, Arriaga C, Yépez-Mulia L.

Epidemiology of trichinellosis in Mexico, Central and South America.

Vet Parasitol. 2000 Dec 1;93(3-4):201-25.

Table 1
Cases and outbreaks of human trichinellosis in Mexico (1952-1997)^a

Year	Place	Number of individuals involved	Deaths
1952	Mexico City	1	0
1952	Mexico City	10	0
1966	Mexico City	2	0
1974	Mexico City	20	0
1975	Zacatecas	1	0
1975	Mexico City	1	0
1976	Zacatecas	1	0
1978	Zacatecas	36	6
1978	State of Mexico	4	0
1978	Mexico City	5	0
1979	Zacatecas	39	0
1980	Mexico City	4	0
1980	State of Mexico	1	0
1981	Zacatecas	7	0
1981	Durango	9	0
1981	Sonora	2	0
1982	Durango	41	1
1982	Zacatecas	25	0
1982	Jalisco	10	1
1982	Mexico City	15	0
1982	State of Mexico	3	0
1983	State of Mexico	18	0
1984	Durango	28	0
1984	Jalisco	-	1
1985	Mexico City	82	1
1985	State of Mexico	57	1
1986	Aguascalientes	1	0
1987a	Chihuahua	166	1
1987b	Zacatecas	49	1
1987c	Mexico City	4	0
1987	Michoacan	1	0
1987	Aguascalientes	1	1
1988a	Mexico City	19	0
1988b,c	Chihuahua	18	0
1988	Aguascalientes	7	0
1988	Michoacan	4	0
1989	Michoacan	1	0
1990	Michoacan	4	0
1990a,b	Jalisco	19	0
1991	Michoacan	18	0
1992a	Jalisco	6	0
1992b	State of Mexico	1	0
1994	State of Mexico	12	0
1996	Mexico City	1	0
1997	State of Mexico	2	0

^a Martinez-Marañón (1979, 1985), Ramírez-Valenzuela (1985), Acha and Szyfres (1986), Sarti-Gutiérrez et al. (1986), Hurtado (1987), Cabral-Soto et al. (1989), Gómez-Torres et al. (1991), Escobedo and Izaguirre (1992), Hernández et al. (1992), Boletín de Epidemiología (1985a,b, 1987a,b,c, 1988a,b,c, 1990a,b, 1992a,b, 1994), Meza-Lucas (personal communication), de-la-Rosa-Arana et al. (1998) and Correa et al. (1997).

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Table 2
Results of surveys for *Trichinella* in pigs at slaughterhouses in various states of Mexico^a

Year	Pigs analyzed	% Positive pigs	Detection method	Place
1909-1913	472031	0.025	Trichinoscopy	Mexico City
1916-1920	318235	1.05	Trichinoscopy	Mexico City
1939	128025	0.030	Trichinoscopy	Mexico City
1943	120208	0.07	Trichinoscopy	Mexico City
1945	450	0.044	Artificial digestion	Mexico City
1949	-	0.77	Trichinoscopy	Mexico City
1951	3000	0.73	Trichinoscopy	State of Mexico
1953	5000	0.6	Trichinoscopy	Mexico City
1953	5000	0.04	Trichinoscopy	Mexico City
1962	300	0.67	Artificial digestion	Mexico City
1962	1500	0.066	Trichinoscopy	-
1962	76935	0.05	Trichinoscopy	Mexico City
1962	300	0.66	Artificial digestion	Mexico City
1964	1500	0.66	Serology	Mexico City
1971	313	0.32	Trichinoscopy	Jalisco
1971	1500	0.0	Trichinoscopy	Tamaulipas
1974	1000	4.2	Trichinoscopy	Mexico City
1975	260271	0.0	Trichinoscopy	Mexico City
1976	341204	0.001	Trichinoscopy	Mexico City
1977	2228	0.27	Serology	Mexico City
1977	496478	0.001	Trichinoscopy	Mexico City
1978	493142	0.002	Trichinoscopy	Mexico City
1979	7200	0.0 and 0.07	Trichinoscopy and serology	State of Mexico
1979	306442	0.005	Trichinoscopy	Mexico City
1980	272355	0.005	Trichinoscopy	Mexico City
1981	477145	0.004	Trichinoscopy	Mexico City
1982	410607	0.003	Trichinoscopy	Mexico City
1983	919099	0.0	Trichinoscopy	Mexico City
1984	394	0.0	Trichinoscopy	Sonora
1986	546	0.91	Artificial digestion	Jalisco
1986	120	0.0	ELISA	Michoacan
1991	50	6.0	Artificial digestion	State of Mexico
1992	119	2.12	ELISA	Michoacan
1992	8000	1.25	Artificial digestion	State of Mexico
1993	715	1.58	ELISA	Michoacan
1993-1994	151908	0.0013	Trichinoscopy	State of Mexico
1999	80	2.5	ELISA	Zacatecas

^a Bejar (1973), Medina (1977), Samano-Cataño (1979), Alvarado (1984), Quiroz (1984), Bautista (1985), Ramírez-Valenzuela (1985), Salazar (1986), Vega-Alarcón (1986), Hurtado (1987), Arriaga et al. (1991), Ruiz-Gallegos (1992), Instituto de Salud del Estado de México (1993-1994) and Moreno-García (personal communication).

Epidemiología Latinoamérica



Table 3

Results of surveys for *Trichinella* in cats, dogs and rats in Mexico (1952–1987)^a

Year	No. of animals	% Positive	Species	Diagnostic method	Place
1947	300	25	Cats	Trichinoscopy	
1950			Cats	Trichinoscopy	Mexico City
1952	15	20	Cats	Serology	Mexico City
1952	38	15.8	Dogs	Serology	Mexico City
1954	900	2	Rats	Trichinoscopy	Mexico City
1962	150	3.3	Cats	Trichinoscopy and AD ^b	Mexico City
1965	1012	0.0	Rats	AD	Mexico City
1974	150	3.3	Dogs	AD	Mexico City
1986	500	1 and 3	Rats	Trichinoscopy and AD	State of Mexico
1987	150	2 and 6	Cats	Trichinoscopy and AD	Mexico City
1995	120	0	Rats	AD	State of Mexico

^a Mazzotti and Alcántara (1954), Samano-Cataño (1979), Ramirez-Valenzuela (1985), Fernández-Sámano (1986), Vega-Alarcón (1986), Acha and Szyfres (1986) and Palma-Rodríguez (1987).

^b Artificial digestion.

Epidemiología Latinoamérica



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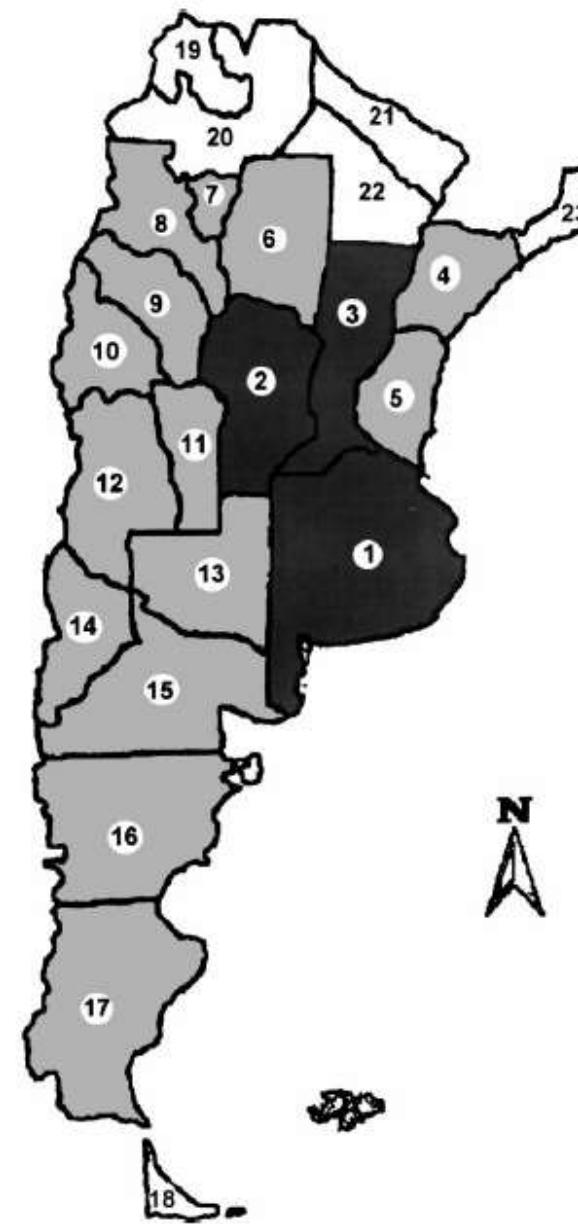


Fig. 2. Provinces of Argentina in which human or animal trichinellosis has been reported. Provinces with more than 600 cases (■) include: Buenos Aires (1), Córdoba (2), Santa Fe (3); provinces with more than 16 cases (▨) include: Corrientes (4), Entre Ríos (5), Santiago Del Estero (6), Tucuman (7), Catamarca (8), La Rioja (9), San Juan (10), San Luis (11), Mendoza (12), La Pampa (13), Neuquen (14), Río Negro (15), Chubut (16), Santa Cruz (17) and Tierra del Fuego (18). Provinces where no cases (□) have been reported include: Jujuy (19), Salta (20), Formosa (21), Chaco (22) and Misiones (23). Compiled by Guarnera (personal communication).

Epidemiología Latinoamérica



Table 4
Distribution of human cases of trichinellosis registered from 1993 to 1999 in Argentina^a

Province	1993	1994	1995	1996	1997	1998	1999 ^b	Total
Buenos Aires	217	386	556	545	744	135	231	2809
Catamarca						13	2	15
Cordoba	100	227	180	79	70	36	1	693
Corrientes	1	10				2		13
Chubut	14	1					89	104
La Pampa	8		7	21				36
La Rioja							3	3
Mendoza							1	1
Neuquen	17	6	1		8		24	56
Rio Negro		7		80	3		2	92
San Luis		1	1	10		7	63	82
San Juan					4		7	11
Santa Cruz		1				6	1	8
Santiago del Estero				1				1
Santa Fe	3	387	84	124	157	68	15	838
Tucuman	1							1
Tierra del Fuego					1			1
Total	361	1026	829	860	987	267	439	4769

^a Boletín de Vigilancia Epidemiológica Nacional (1993–1998).

^b Records obtained from the Sector de Vigilancia Epidemiológica up to the 42nd week of 1999. Data compiled by Guarnera (personal communication).

Epidemiología Latinoamérica



Table 5

Results of surveys for *Trichinella* in swine in the province of Buenos Aires as determined by serological and parasitological methods^a

County	No. of pigs	No. positive by IIF	No. positive by parasite detection
Balcarce	137 ^b	14	ND ^c
Mar de la Plata	33 ^b	19	ND
Nacochea	64 ^b	26	ND
Maipu	60 ^d	21	11 ^e
San Fernando	—	—	—
Total	264	80	11

^a Costantino et al. (1994).

^b Swine from farms located in the area in which the outbreak had been detected.

^c Not done.

^d Swine from the farm in which the outbreak had been detected.

^e Five by trichinoscopy and six by artificial digestion.

Epidemiología Latinoamérica



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Fig. 3. Regions of Chile in which human or animal trichinellosis has been reported. Regions include: Tarapaca (1), Antofagasta (2), Atacama (3), Coquimbo (4), Valparaiso (5), Region Metropolitana (6) which includes Santiago (7), O'Higgins (8), Maule (9) which includes Linares (10), Bio-Bio (11) which includes Concepcion (12), Araucania (13) which includes Temuco (14) and Cautin (15), Los Lagos (16) which includes Valdivia (17) and Llanquihue (18), Aisen (19), Magallanes (20) and Tierra del Fuego (21).

Epidemiología Latinoamérica

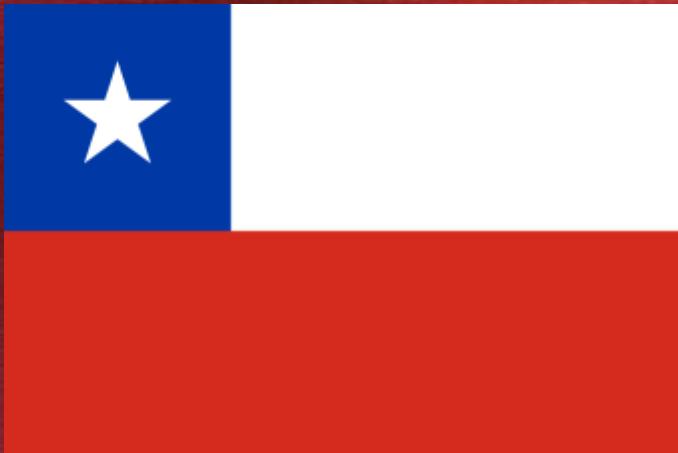


Table 6

Incidence rates and mortality of human trichinellosis in Chile from 1963 to 1995^a

Year	No. of cases	Rate per 100,000	% Mortality
1963–1967	443	1.4	2.2
1968–1972	469	1.2	2.1
1973–1977	360	0.7	4.4
1980	72	0.8	6.9
1981	66	0.6	1.5
1982	220	1.9	1.4
1983	49	0.4	6.1
1984	95	1.2	1.1
1985	92	0.8	0
1986	73	0.6	2.7
1987	73	0.6	2.7
1988	86	0.7	0
1989	88	0.7	1.1
1990	81	0.6	2.1
1991	100	0.8	2.0
1992	94	0.7	0
1993	39	0.3	0
1994	42	0.3	2.4
1995	77	0.5	0
Total	2619	0.8	2.2

^a Schenone (1984) and Schenone et al. (1997).

Epidemiología Latinoamérica



Table 7

Frequency of *Trichinella* detection in samples of diaphragm muscle taken at random from autopsied cases at the Medical Legal Service in Santiago, Chile^a

Age (years)	1966	1972	1982	1992	1997
0–19	2	0	0	0	1
20–39	4	1	1	4	0
40–59	12	9	3	3	0
>60	4	7	10	3	3
Total	22/1000	17/500	14/500	10/500	4/496
%	2.2	3.4	2.8	2.0	0.8

^a Schenone et al. (1997).

Epidemiología Latinoamérica

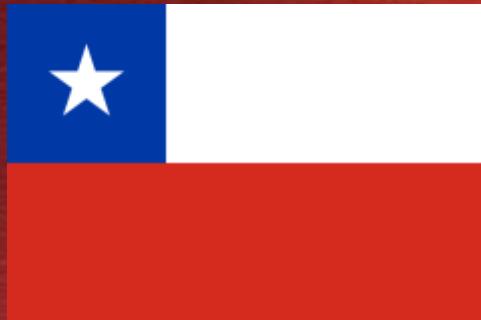


Table 8
Outbreaks of human trichinellosis outbreaks in Chile from 1960 to 1995^a

Province	No. of outbreaks	No. of cases/outbreak	Total	Year
Antofagasta	2	15, 48	63	1962, 1963
Valparaíso	1	10	10	1962
Metropolitan	8	33, 67, 35, 57, 45, 43, 128, 48	456	1961, 1965, 1966, 1967, 1968, 1969, 1970, 1971
O'Higgins	1	17	17	1967
Linares	1	19	19	1968
Cautín	3	57, 13, 25	95	1966, 1967, 1969
Valdivia	4	13, 22, 14, 22	71	1961, 1962, 1963, 1966
Llanquihue	1	14	14	1961
Chiloé	1	20	20	1964
Magallanes	1	47	47	1968
Valparaíso	2			1975, 1979
Metropolitan	2			1975, 1979
O'Higgins	1			1975
Concepción	2			1977, 1979
Malleco	4			1975, 1977, 1978, 1979
Cautín	1			1978
Valdivia	1			1978
Llanquihue	1			1979
Tierra del Fuego				1978
Valparaíso	2		84	1988, 1991
Metropolitan (Santiago)	4		286	1981, 1982, 1984, 1985
O'Higgins	2		57	1992, 1995
Bio-Bio	9		309	1986, 1987, 1989, 1990, 1993, 1995
Araucanía	5		194	1982, 1986, 1989, 1995
Los Lagos	9		374	1980, 1981, 1982, 1984, 1989, 1990, 1991, 1992
Total outbreaks		68		

^a Schenone (1984) and Schenone et al. (1972, 1997).

Epidemiología Latinoamérica



Table 9
Prevalence of *T. spiralis* infection in swine examined by trichinoscopy during the period 1976–1983^a

Region	No. examined	No. positive	% Positive
I Tarapaca	31613	10	0.036
II Antofagasta	15285	0	0
III Atacama	6574	0	0
IV Coquimbo	24692	1	0.004
V Valparaíso	341706	131	0.038
Metropolitan	2691467	806	0.030
VI O'Higgins	188924	78	0.041
VII Maule	152978	226	0.148
VIII Bío-Bío	469935	1635	0.345
IX Araucanía	216010	718	0.332
X Los Lagos	293115	501	0.171
XI Aisén	8480	52	0.613
XII Magallanes	47505	29	0.061
Total	4488284	4187	0.093

^a Schenone (1984).

Epidemiología Latinoamérica

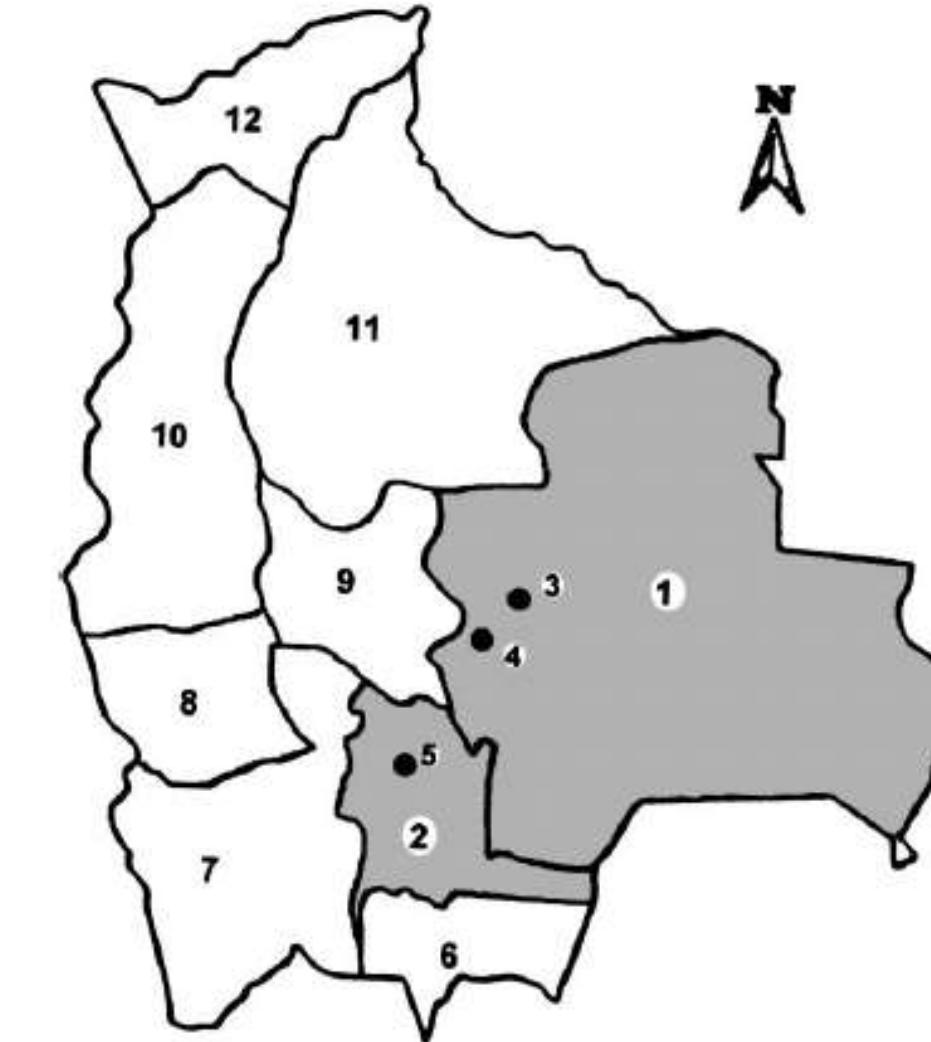


Fig. 4. Areas in Bolivia where *Trichinella* in swine has been reported. Swine production areas in the Departments of Santa Cruz (1) and Chuquisaca (2) where *Trichinella* has been reported include: Santa Cruz de la Sierra (3), Valle Grande (4) and Monteagudo (5). Departments where no cases have been reported include: Potosí (6), Oruro (7), Cochabamba (8), La Paz (9), Beni (10), and Pando (11). Source: Brown et al. (1996).



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Review Article

J Infect Dev Ctries 2012; 6(3):216-222.

Trichinellosis in developing countries: is it neglected?

Fabrizio Bruschi

*Department of Experimental Pathology, M.B.I.E., Università di Pisa, Pisa, Italy
Member of the Executive Committee of the International Commission on Trichinellosis*

Republic of Chile

In the period between 1991 and 2004, a total of 698 human cases were reported with an average incidence of 0.36%, caused by domestic pig meat consumption [2]. As in Argentina, *Trichinella spiralis* has been found in both domestic and wild animals [11]. No information is available at present from Colombia, Costa Rica, Paraguay, Peru, Uruguay, Venezuela, etc.

Plurinational State of Bolivia

Trichinella spp. larvae were never found previously in either animals or humans, but sera from domestic pigs originating from different country regions were found positive for anti-*Trichinella* antibodies [9,10]. In a recent serological survey of 255 pigs in the eastern part of the country, a positivity rate of 2.3% was found, probably due to cross-reactivity (Macchioni, personal communication).

Region of the Americas

Argentine Republic

Today in Argentina, there are endemic, non-endemic and *Trichinella*-free provinces [4]; however, infected animals have been recently discovered in some areas which were considered until now *Trichinella*-free, such as in the National Park Administration, located in the Centre-east of the Entre Ríos province, along the western riverside of the Uruguay River, where 11.4% of tested wild boars were found to be infected with *T. spiralis* although with a low parasite burden [5]. In the period between 1990 and 2005, a total of 5,221 human cases were reported with an average incidence of 1.48%, caused

Epidemiología Latinoamérica



Tabla 2. Procedencia de cerdos muestrados.

MUNICIPIO	TOTAL	NEGATIVO	POSITIVO
Armenia Mantequilla	4	4	0
Barbosa	21	21	0
Carolina del Príncipe	22	22	0
Cisneros	10	10	0
Don Matías	39	39	0
Ebéjico	14	14	0
Entrerríos	26	26	0
Guarne	11	11	0
Marinilla	3	3	0
San Antonio de Prado	10	10	0
Santa Rosa de Osos	28	28	0
Yarumal	6	6	0
TOTAL GENERAL	194	194	0

¿Qué es la triquinelosis?

Clinical Microbiology Reviews, Jan. 2009, p. 127–145

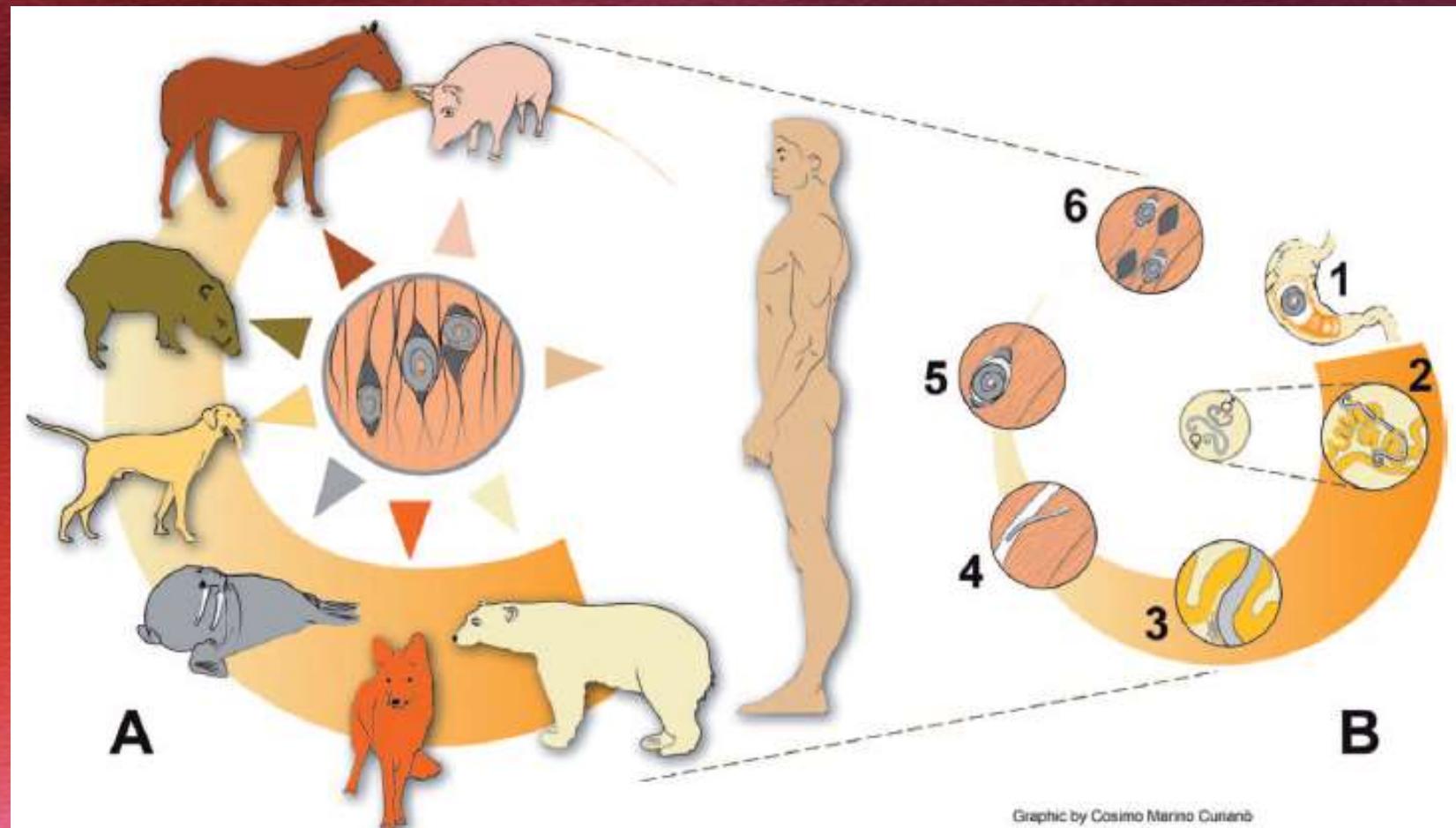
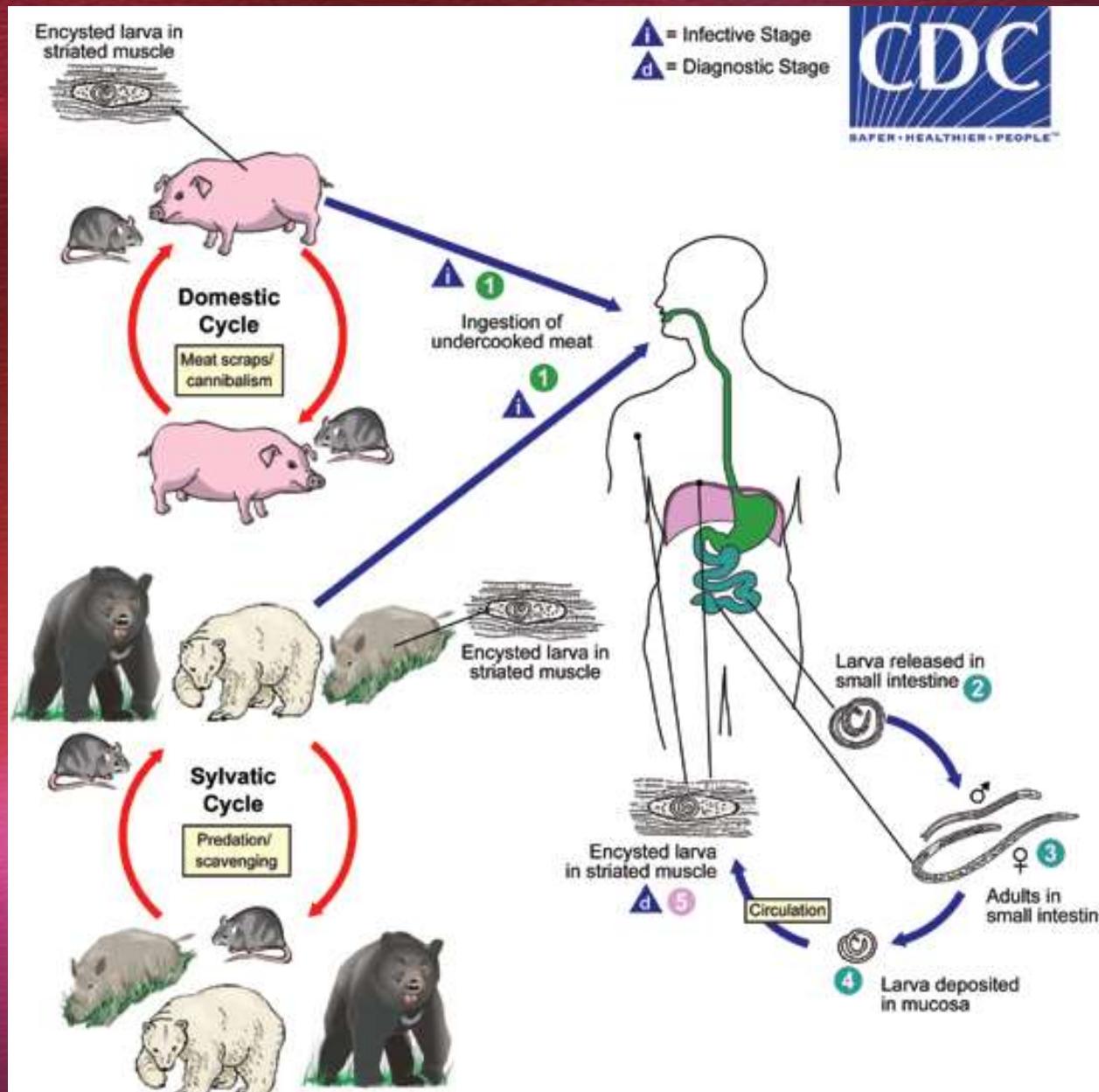


FIG. 1. *Trichinella* sp. life cycle. (A) Main sources of *Trichinella* sp. infections for humans (including pigs, horses, wild boars, dogs, walruses, foxes, and bears). (B) *Trichinella* sp. cycle in the host body. In the enteral phase, muscle tissues are digested in the stomach, and larvae are released (1); larvae penetrate the intestinal mucosa of the small intestine and reach the adult stage within 48 h p.i., and male and female mate (2); female worm releases newborn larvae in the lymphatic vessels (from the fifth day p.i. onwards; the length of newborn production, from 1 week to several weeks, is under the influence of host immunity) (3). In the parenteral phase, the newborn larvae reach the striated muscle and actively penetrate in the muscle cell (4); the larva grow to the infective stage in the nurse cell (the former muscle cell) (5); and, after a period of time (weeks, months, or years), a calcification process occurs (6). (Modified from www.iss.it/site/Trichinella/index.asp with permission of the publisher.)

Ciclo - Triquinosis



Life Cycle

The **female lives for 30 days** and is **viviparous**.

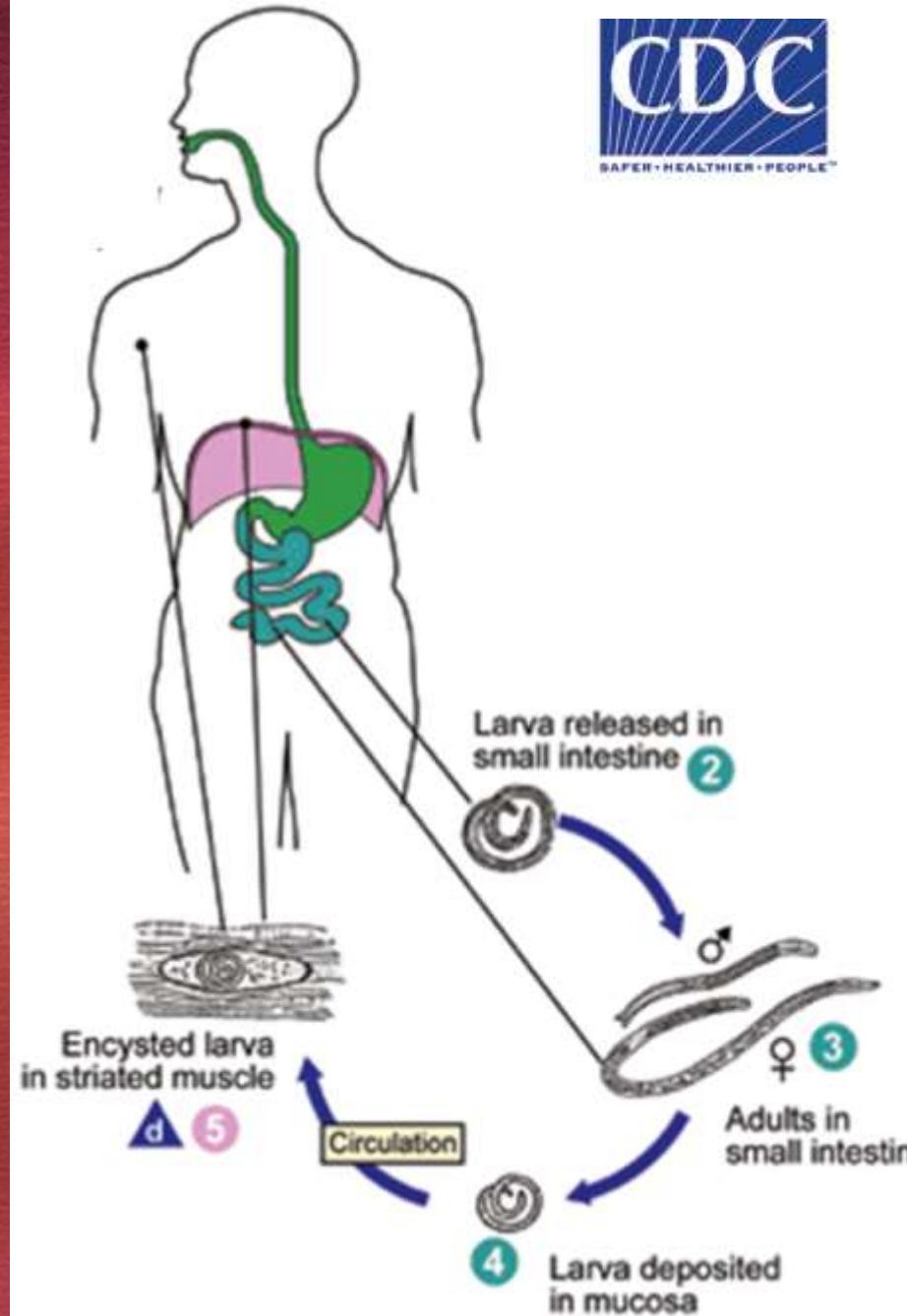
The eggs ($20 \mu\text{m}$) live in the upper uterus and the larvae ($100 \times 6 \mu\text{m}$) break out, living free in the uterine cavity. (**INTERNOS**)

One female produces more than 1500 larvae.

The larvae, which emerge as early as **4–7 days** after infection, continue to be produced for **4–16 weeks**.

*They make their way via the lymphatics and blood circulation to the right heart and lungs, enter the arterial circulation and reach **striated muscle**, where they encyst.*

Ciclo - Triquinosis



Trichinella larva in pressed bear meat, partially digested with pepsin.



Trichinella larva in tongue muscle of a rat, stained with hematoxylin and eosin (H&E). Image was captured at 400x magnification.

Cystic Stage

- The cyst is formed by the larva encapsulated by the host tissue.
- The capsule is an **adventitious ellipsoidal sheath** with blunt ends resulting from cellular reaction around the **tightly coiled larva**.
- The long axis parallels that of the muscle fibres and host amino acids nourish it so that it can remain alive for many years.
- **In humans calcification may take place after 6 months and lead to death of the larva.**
- When consumed by a **carnivorous host the cysts are digested in the stomach and after excysting the larvae**, which are resistant to gastric juice, invade the duodenal and jejunal mucosa, where they penetrate the columnar epithelium and develop into adults after **36 hours**.
- The period between **infection and the encysting stage in the muscles is 17–21 days**.

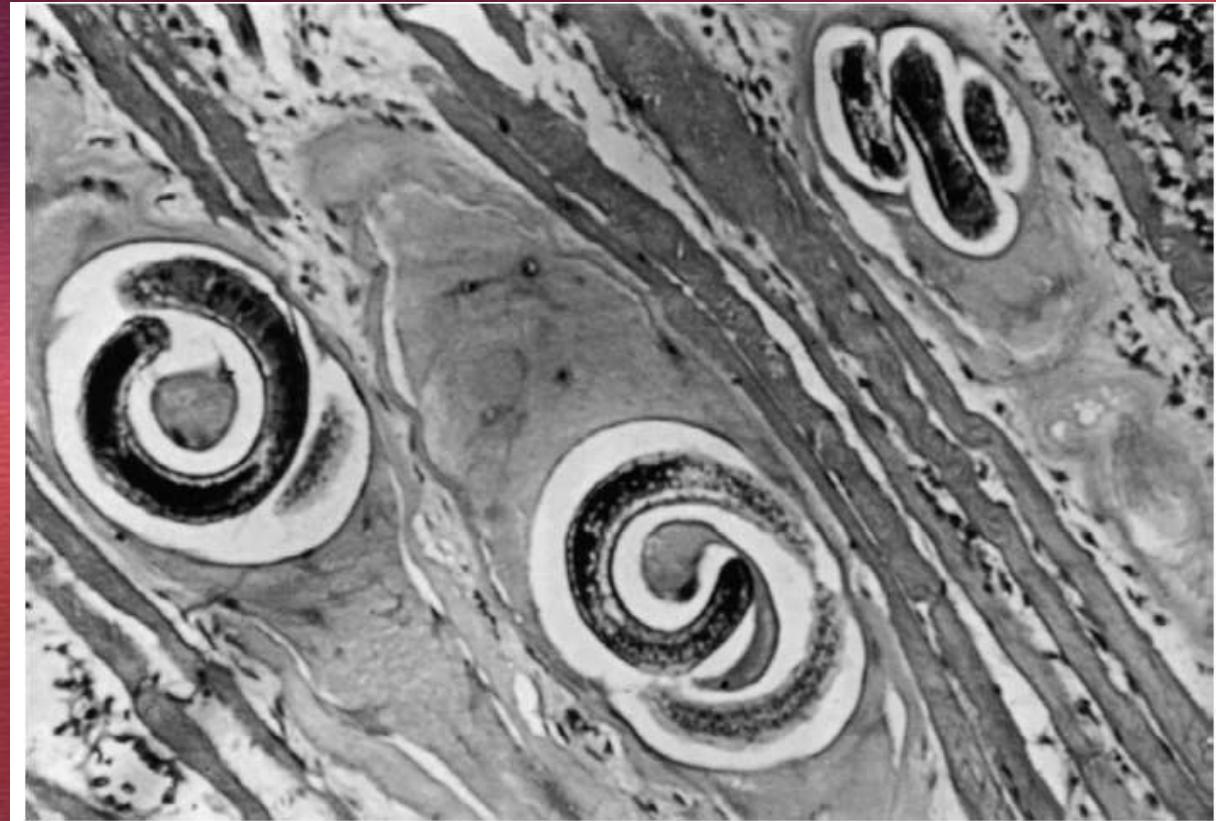
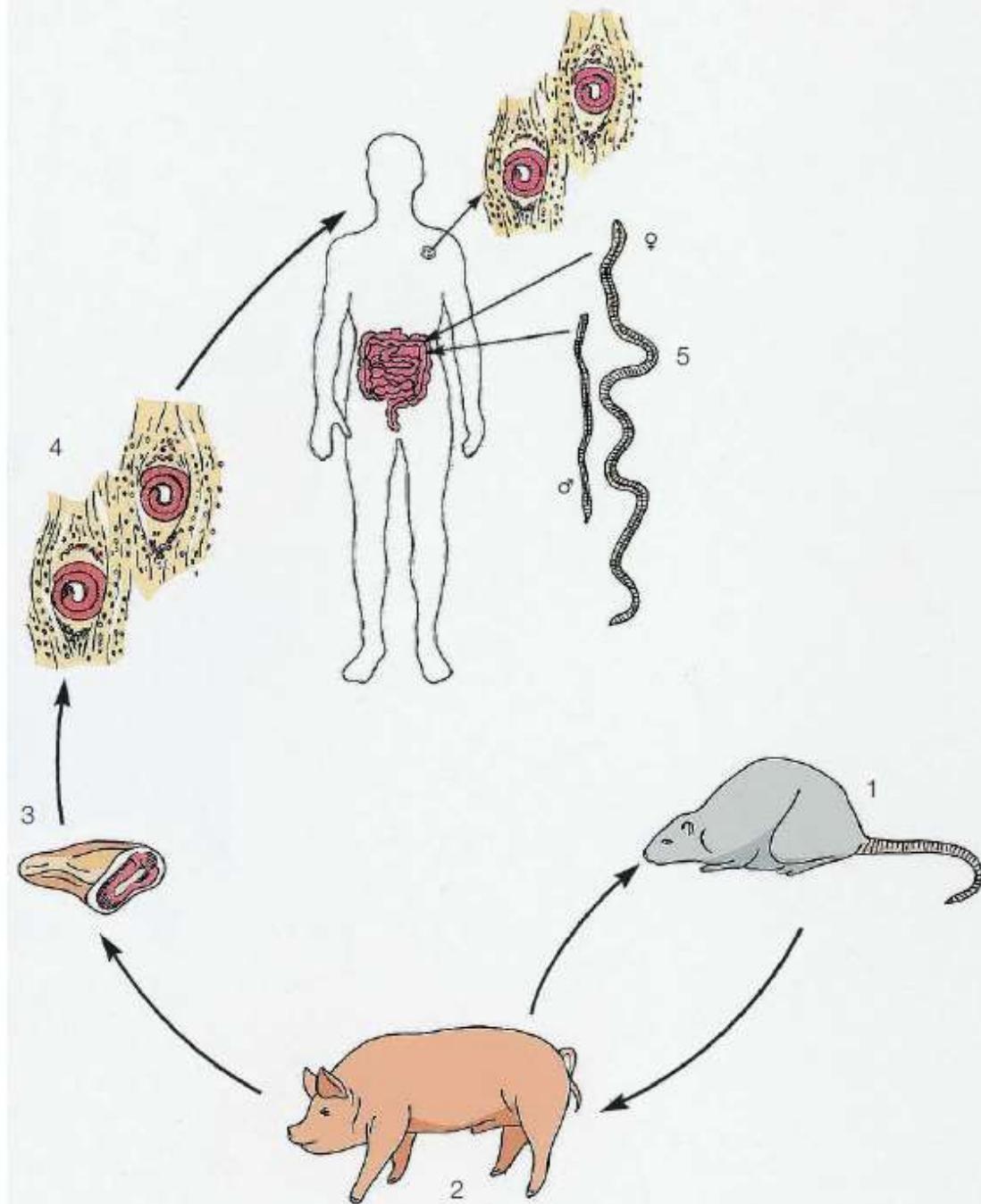


Figure 55.19 Larvae of *Trichinella spiralis* in muscle.

Transmisión

Transmission is by mouth from eating raw or undercooked meat. The reservoir hosts of infection vary according to subspecies.

- *T. s. spiralis* infection is acquired from eating undercooked pork from infected pigs. The pigs are infected from eating raw garbage or perhaps from eating rats which themselves become infected from garbage.
- *T. s. nativa* infection is acquired from eating bear meat (the top predator), polar bear in the Arctic and brown bears in sub-Arctic regions of the former USSR and North America. Walrus meat can also be infective. Polar explorers have died as a result of eating polar bear meat.
- *T. s. nelsoni* infection results from eating bush pig or wart-hog meat which are themselves infected from carrion.
- *T. britovi* is found in sylvatic carnivores and humans can become infected from eating wild boar or horse.
- *T. pseudospiralis* is typically acquired from eating wild pig or boar meat. This species also infects birds.



711. Ciclo vital de *Trichinella spiralis*

Este nematodo causa una infestación zoonótica que circula entre las ratas (1) y diversos carnívoros. La triquinosis humana se debe con frecuencia al consumo de carne o de productos del cerdo (como las salchichas) crudos o poco cocidos. Los cerdos domésticos (2) y los jabalíes suelen adquirir la infestación tras consumir ratas afectadas (1). También existen ciclos de la infestación en cánidos salvajes y en otros carnívoros que se alimentan de roedores. La infestación se adquiere por el consumo del músculo (3) que contiene las larvas enquistadas (4). Estas larvas salen de los quistes en el intestino delgado y se transforman en diminutos adultos (5) en la mucosa. Hacia los 5 días de la infestación las hembras (ahora maduras) depositan las larvas, que migran a través de los tejidos hasta alcanzar los músculos esqueléticos, en los que vuelven a enquistarse. La puesta de larvas puede continuar durante una semana o más. Finalmente, las larvas se calcifican. En este género se han descrito otras tres especies (o subespecies) que pueden infectar al ser humano: *Trichinella nelsoni* en diversas partes de África y del sur de Europa; *Trichinella nativa* en la región ártica, y *Trichinella pseudospiralis*, que actualmente presenta una distribución muy amplia. En 1999, *T. pseudospiralis* dio lugar a varios brotes de infestación humana en el sur de Francia a consecuencia del consumo de carne de jabalí.



712. Reservorio salvaje de la triquinosis

Un reservorio frecuente de la infección es el cerdo salvaje, como el cerdo africano de los matorrales de la imagen. La carne de otros carnívoros, como el oso, también ha originado brotes aislados de infestación humana, por ejemplo, en las partidas de caza. Estudios epidemiológicos recientes han demostrado que la incidencia de la triquinosis humana está aumentando en todos los continentes. Por ejemplo, en Chile se detectaron larvas calcificadas de *Trichinella spiralis* en el 2% de todas las autopsias que se realizaron en 1992.

TABLE 1. Main epidemiological features of *Trichinella* species and genotypes^a

Species or genotype	Geographical distribution	Host range	Main source of infection of humans	Resistance of larvae in frozen muscles
Encapsulated				
<i>T. spiralis</i>	Cosmopolitan	Domestic and sylvatic mammals	Domestic and sylvatic swine horses	Yes in horse muscles
<i>T. nativa</i>	Arctic and subarctic areas of America, Asia, Europe	Sylvatic carnivores	Bears, walruses	Yes in carnivore muscles
<i>Trichinella</i> genotype T6	Canada, Alaska, Rocky Mountains, and Appalachian Mountains in the United States	Sylvatic carnivores	Carnivores	Yes in carnivore muscles
<i>T. britovi</i>	Temperate areas of Europe and Asia, Northern and Western Africa	Sylvatic mammals and seldomly domestic pigs	Wild boars, domestic pigs horses, foxes, jackals	Yes in carnivore and horse muscles
<i>Trichinella</i> T8	South Africa and Namibia	Sylvatic carnivores	None documented	No
<i>T. murrelli</i>	United States and Southern Canada	Sylvatic carnivores	Bears, horses	No
<i>Trichinella</i> genotype T9	Japan	Sylvatic carnivores	None documented	No
<i>T. nelsoni</i>	Eastern-Southern Africa	Sylvatic mammals	Warthogs, bush pigs	No
<i>Trichinella</i> genotype T12	Argentina	Cougars	None documented	Unknown
Nonencapsulated				
<i>T. pseudospiralis</i>	Cosmopolitan	Sylvatic mammals and birds, domestic pigs	Domestic and wild pigs	No
<i>T. papuae</i>	Papua New Guinea, Thailand	Wild pigs, saltwater crocodiles	Wild pigs	No
<i>T. zimbabwensis</i>	Zimbabwe, Mozambique, Ethiopia, South Africa	Nile crocodiles, monitor lizards	None documented	No

^a Based on data from reference 125.

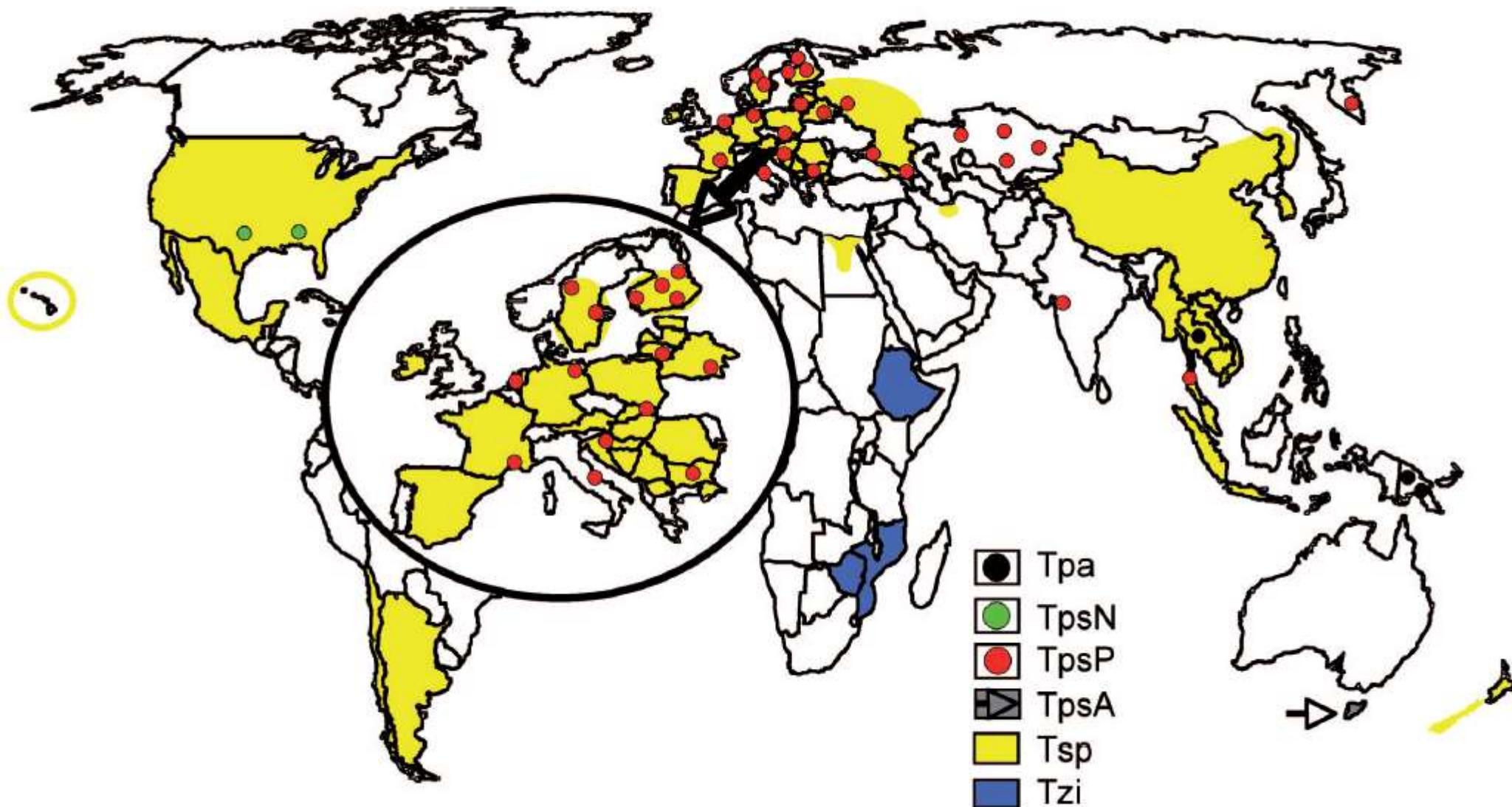


FIG. 2. World map showing the distribution areas of *Trichinella spiralis* (Tsp), *Trichinella pseudospiralis* from north America (TpsN), *T. pseudospiralis* from Europe and Asia (TpsP), *T. pseudospiralis* from Tasmania (TpsA), *Trichinella papuae* (Tpa), and *Trichinella zimbabwensis* (Tzi). (Modified from www.iss.it/site/Trichinella/index.asp with permission of the publisher.)

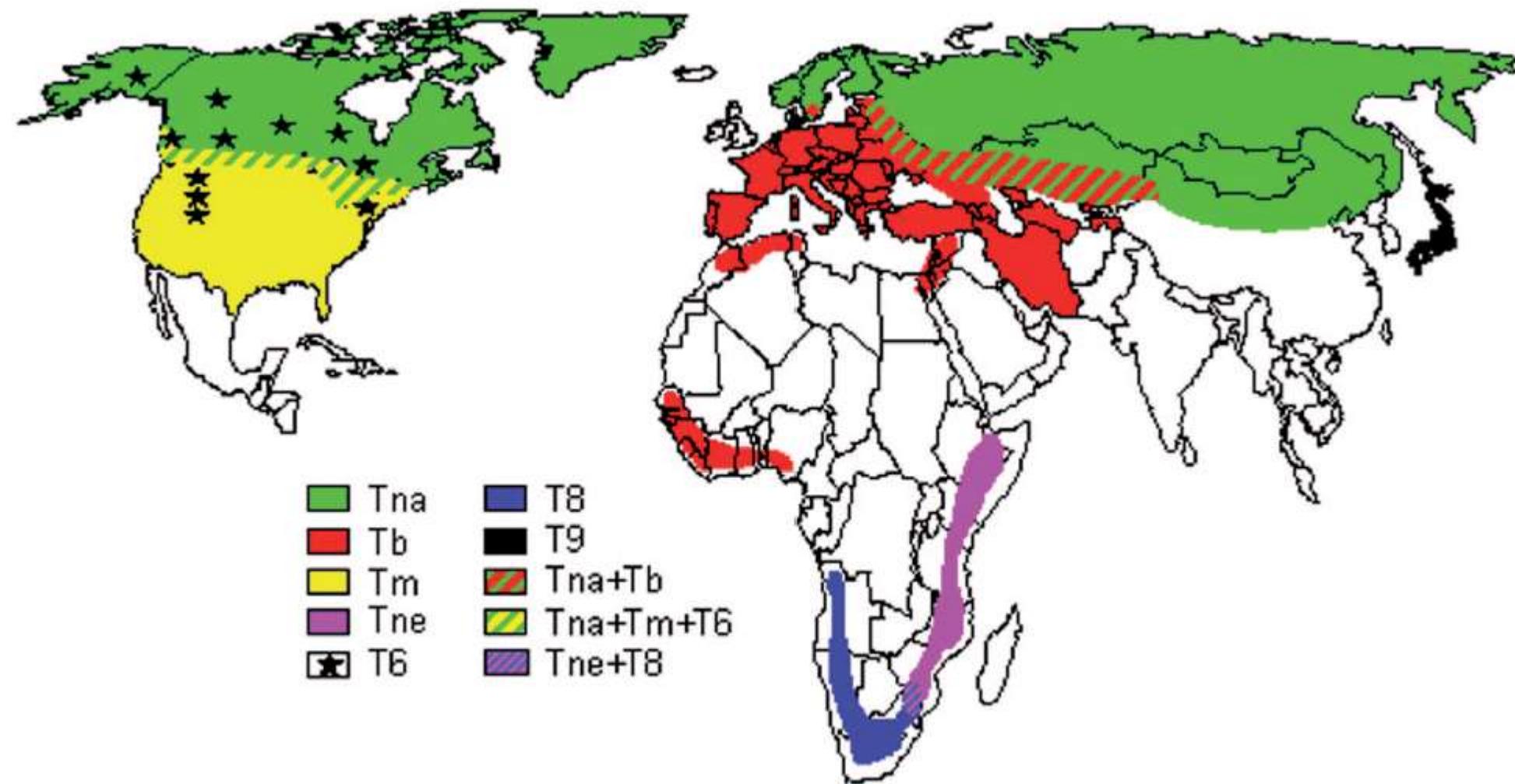


FIG. 3. World map showing the distribution areas of *Trichinella nativa* (Tna), *Trichinella britovi* (Tb), *Trichinella murrelli* (Tm), *Trichinella nelsoni* (Tne), *Trichinella* genotype T6 (T6), *Trichinella* genotype T8 (T8), and *Trichinella* genotype T9 (T9). In some regions, the distribution areas of these encapsulated species and genotypes overlap between them. (Modified from www.iss.it/site/Trichinella/index.asp with permission of the publisher.)

Formas clínicas

TABLE 4. Classification of different clinical forms of trichinellosis, in dependence of the severity of signs and larval density^a

Clinical form/ outcome of infection ^b	Serology	Presence of eosinophils (>500 eosinophils per mm ³)	Presence of main clinical signs (fever, edema, myalgia)	Recovery after infection	Hypoalbuminemia	Complications	Estimated no. of larvae/g muscle	Hospitalization	Putative fatality
Asymptomatic	+	Transient	—	—	—	—	<10	—	—
Abortive	+	+	Transient (1–2 days)	—	—	—	>	—	—
Mild	+	+	+	3 wk	—	—	>	—	—
Pronounced	+	+	++	6 wk	+/-	Rare	>	+/-	—
Severe	+	Sometimes absent	+++	>6 mo	+	Frequent	>100	+	+/-

^a Modified from reference 73 with permission of the publisher, with additional data from reference 153.

^b The asymptomatic form of trichinellosis relates to a history of exposure, but signs and/or symptoms are lacking. The diagnosis of asymptomatic cases is usually based upon serological findings. In the abortive form, the clinical signs and symptoms are weakly expressed and last up to a few days; diagnosis should also be confirmed by serological testing. The mild form exhibits a low intensity of signs and/or symptoms. No complications are encountered, and serological testing is indispensable in establishing a diagnosis. The pronounced form is characterized by the appearance of the complete syndrome of significant intensity, but complications are rare, and if present, they are benign and vanish soon. The severe form is characterized by the development of the full syndrome of highly pronounced signs and symptoms with metabolic disturbances accompanied by circulatory and/or neurological complications.

Formas Clínicas



716. Paciente con triquinosis aguda

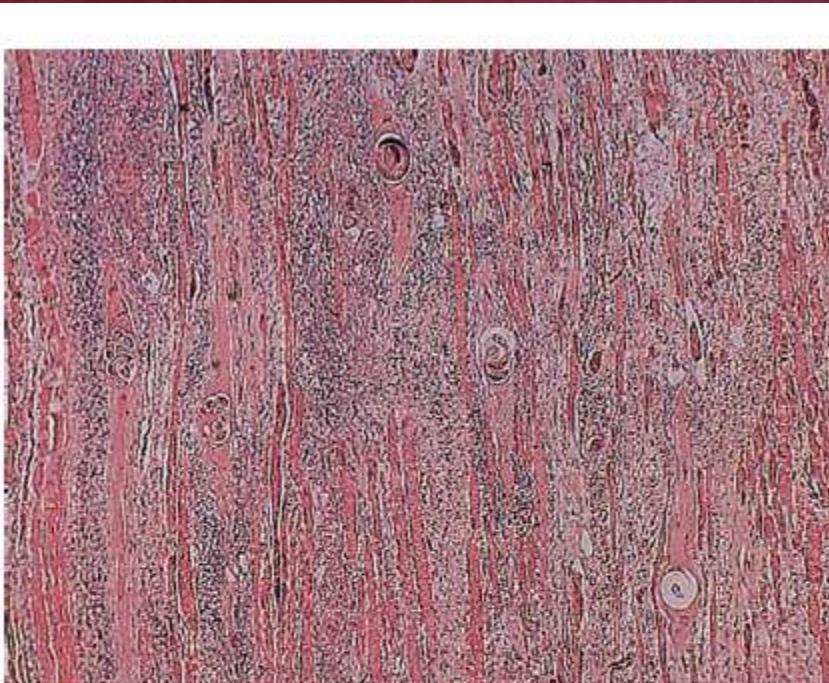
Los cuatro signos cardinales de la enfermedad son fiebre, edema orbitario, mialgias y eosinofilia.



717. Hemorragias «en astilla» en la triquinosis

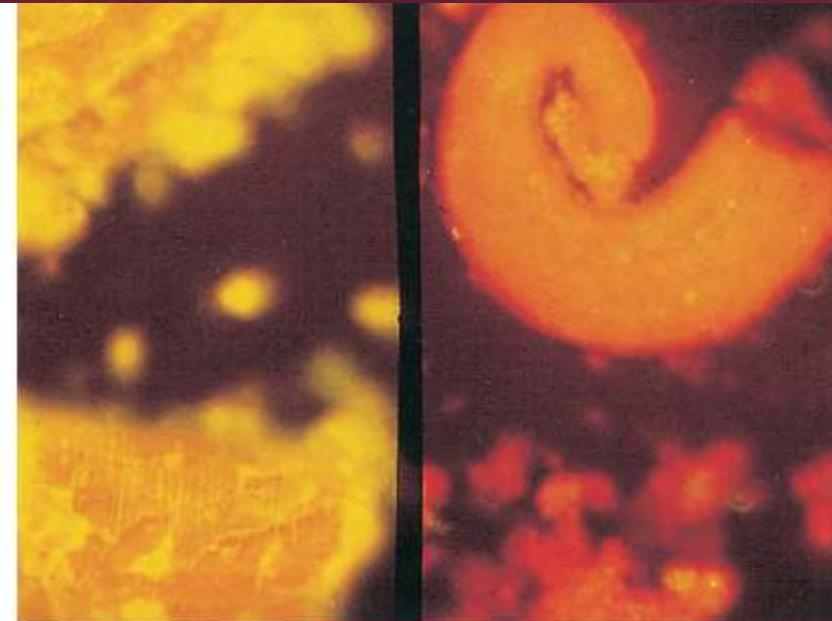
Las hemorragias en los lechos ungueales son un signo frecuente en la triquinosis aguda.

Formas Clínicas



718. Larvas en el músculo de un caso humano mortal

Muchas infestaciones son asintomáticas, pero las más intensas pueden causar miocarditis o encefalitis letales. Las larvas enquistadas se pueden detectar en los músculos en la biopsia o en la autopsia. La calcificación de las larvas enquistadas tiene lugar aproximadamente a los 18 meses en las infecciones menos graves y se puede detectar mediante radiología; no obstante, las larvas enquistadas permanecen vivas durante años. (*Hematoxilina y eosina, ×16*)



719. Prueba con anticuerpos fluorescentes

Aunque la inmunidad principal es la mediada por células, a las 2-4 semanas de la infección se pueden detectar anticuerpos circulantes frente a *Trichinella spiralis*. En la actualidad se están desarrollando antígenos diagnósticos refinados para su detección. Por el momento, la sencilla técnica de IFAT, con el empleo de fragmentos de larvas como antígenos, es una herramienta diagnóstica útil. Las pruebas de la bentonita y el látex con antígenos larvarios extraídos también han sido útiles en la fase aguda, durante la que se desarrollan títulos elevados de anticuerpos. También existe una prueba de ELISA. (Derecha, control negativo.)

Diagnósticos diferenciales

TABLE 5. Differential diagnosis of trichinellosis^a

Clinical finding	Disease to be differentiated
Protracted diarrhea	Salmonellosis, shigellosis, and other viral, bacterial, or parasitic infections of the gastrointestinal tract
High fever and myalgia.....	Influenza virus infection
Periorbital or facial edema with fever	Glomerulonephritis, serum sickness, toxic-allergic reactions to drugs or allergens, polymyositis, periarteritis nodosa, dermatomyositis
High fever and neurological symptoms without periorbital edema	Typhoid fever
Intense headaches, fever, nuchal pseudorigidity with blurred consciousness and drowsiness, irritability, and neurological symptoms	Cerebrospinal meningitis, encephalitis, neuroinfections
Intraconjunctival hemorrhages, intradermal petechiae, fever	Leptospirosis, bacterial endocarditis, and typhus exanthematicus
Eosinophilia combined with myalgia and an inflammatory response	Eosinophilia-myalgia syndromes (e.g., toxic oil syndrome, tryptophan intake, and eosinophilic fasciitis)
Eosinophilia combined with fever	Fasciolasis, toxocarosis, and invasive schistosomosis

^a Based on data from references 26 and 29.

Definición de Caso (CDC)

TABLE 6. Case definition for human trichinellosis according to the European Center for Disease Control^a

Criterion group	Prerequisites and case classification ^b
Clinical	At least three of the following six: fever, muscle soreness and pain, gastrointestinal symptoms, facial edema, eosinophilia, and subconjunctival, subungual, and retinal hemorrhages
Laboratory	At least one of the following two laboratory tests: demonstration of <i>Trichinella</i> larvae in tissue obtained by muscle biopsy and demonstration of <i>Trichinella</i> -specific antibody response by indirect immunofluorescence, ELISA, or Western blot (i.e., seroconversion)
Epidemiological.....	At least one of the following three: consumption of laboratory-confirmed parasitized meat, consumption of potentially parasitized products from a laboratory-confirmed infected animal, epidemiological link to a laboratory-confirmed human case by exposure to the same common source

^a Modified from reference 29 with permission of the publisher.

^b Case classification is as follows: possible case, not applicable; probable case, any person meeting the clinical criteria and with an epidemiological link; confirmed case, any person meeting the laboratory criteria and with clinical criteria within the past 2 months (to be reported to the European Union level).

Diagnóstico etiológico



713. Larvas en una preparación por aplastamiento

Las larvas se pueden detectar fácilmente en fragmentos de músculo mediante el aplastamiento del tejido entre dos portaobjetos, con inspección posterior mediante un «triquinoscopio» (un sencillo sistema de aumento). ($\times 175$)



714. Larva libre en el jugo gástrico

Las larvas pueden liberarse del tejido para un examen más detallado mediante la digestión con jugo gástrico artificial de un fragmento de músculo contaminado. ($\times 175$)



715. *Trichinella spiralis* hembra parasitaria

El gusano hembra tiene una longitud aproximada de 2-3 mm y un diámetro de 90 μm ; el gusano macho mide 1.2 μm y tiene un diámetro de 60 μm . ($\times 45$)

▼ Encysted larvae of *Trichinella* in tissue, stained with hematoxylin and eosin (H&E).

Adult *Trichinella* spp. reside in the intestinal tract of the vertebrate host; larvae can be found encapsulated in muscle tissue. Diagnosis is usually made serologically or based on observation of the larvae in muscle tissue following biopsies or autopsies.

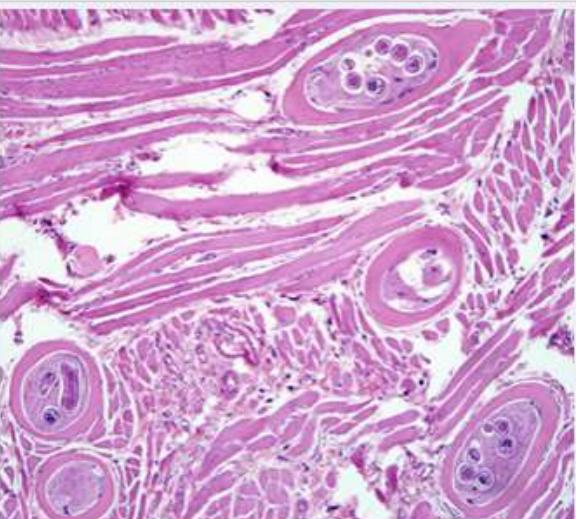


Figure A: Encysted larvae of *Trichinella* sp. in muscle tissue, stained with hematoxylin and eosin (H&E). The image magnification is 200x.

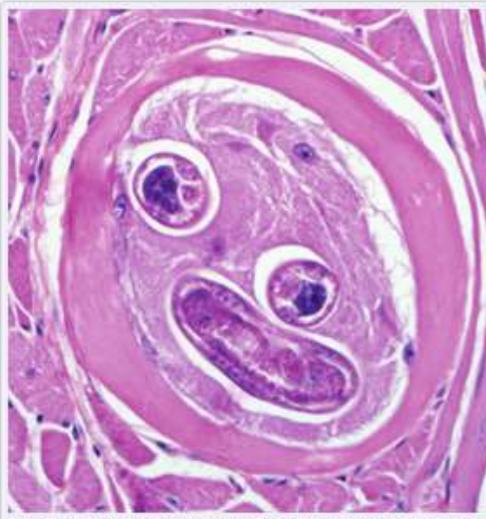


Figure B: Encysted larvae of *Trichinella* sp. in muscle tissue, stained with hematoxylin and eosin (H&E). The image magnification is 400x.

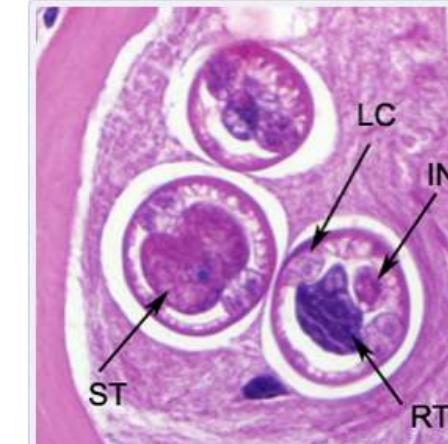


Figure E: Higher-magnification of the larvae in **Figure C**. Shown in these cuts are a nucleated stichocyte (ST), prominent lateral chords, or bacillary bands, (LC), immature reproductive tubes (RT), and the intestine (IN). Image captured at 1000x magnification.



Figure C: Encysted larvae of *Trichinella* sp. in muscle tissue, stained with hematoxylin and eosin (H&E). Image was captured at 400x magnification.

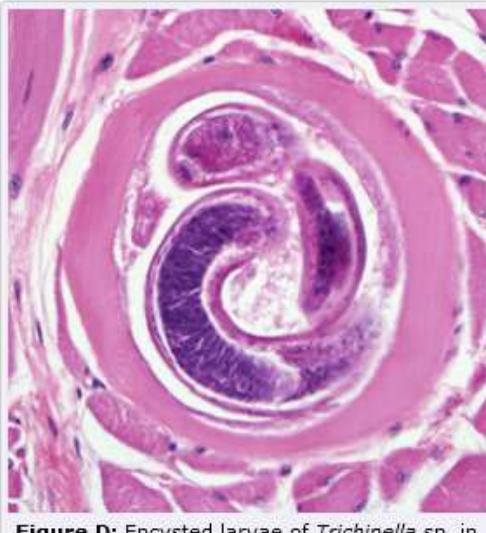


Figure D: Encysted larvae of *Trichinella* sp. in muscle tissue, stained with hematoxylin and eosin (H&E). Image was captured at 400x magnification.

▼ ***Trichinella* larvae in tongue tissue of a rat, stained with H&E.**

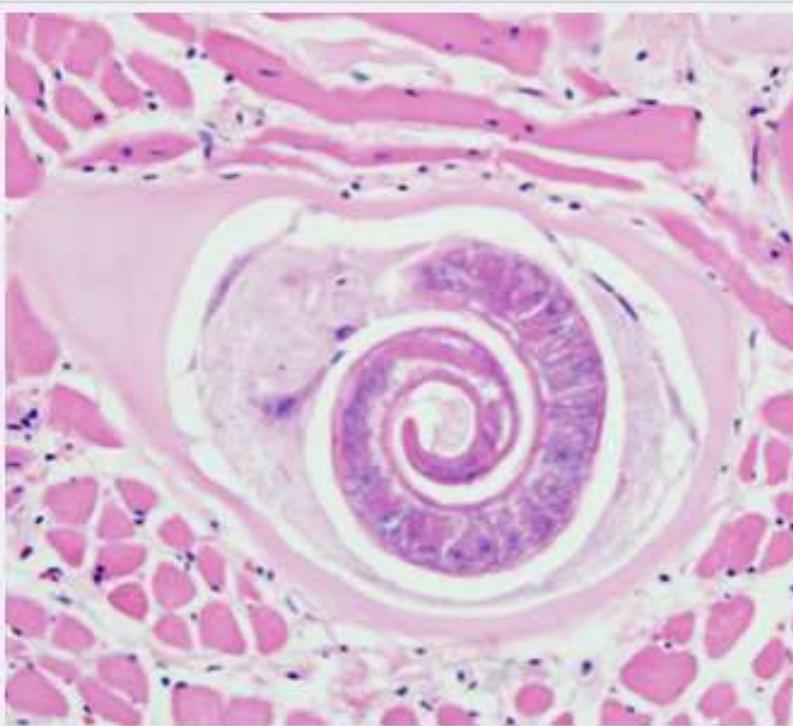


Figure A: *Trichinella* larva in tongue muscle of a rat, stained with hematoxylin and eosin (H&E). Image was captured at 400x magnification.

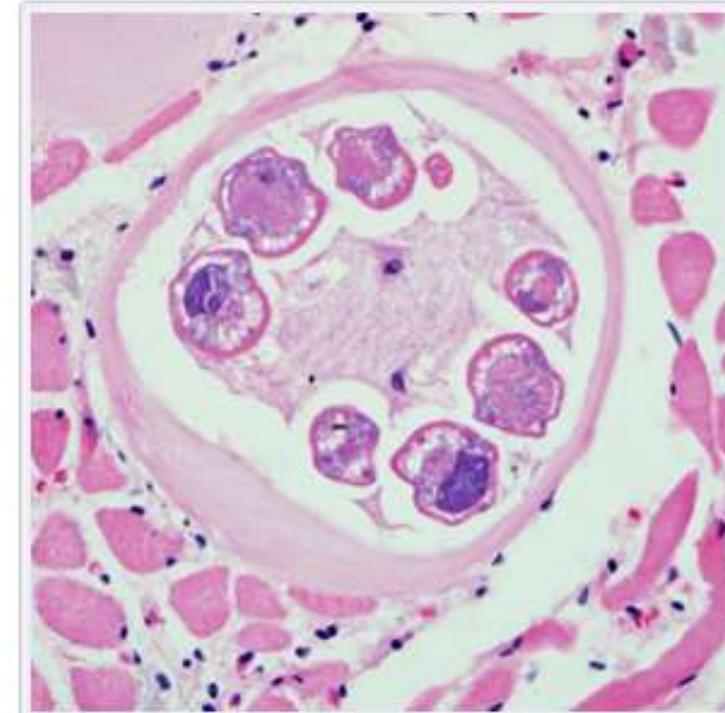


Figure B: *Trichinella* larva in tongue muscle of a rat, stained with hematoxylin and eosin (H&E). Image was captured at 400x magnification.

▼ **Larvae of *Trichinella* from bear meat.**

The following images show *Trichinella* larvae in pressed bear meat, partially digested with pepsin.

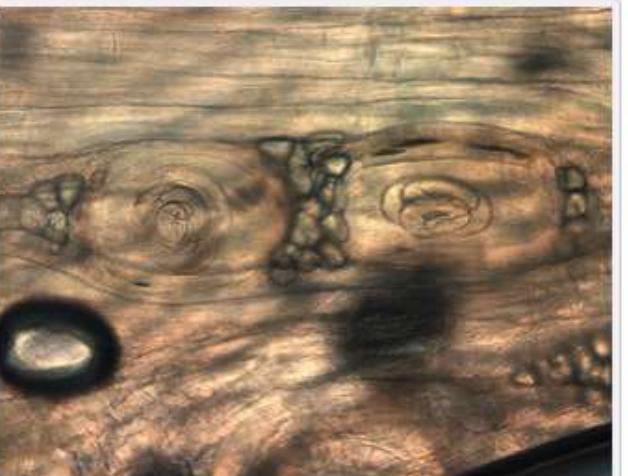


Figure A: *Trichinella* larvae in pressed bear meat, partially digested with pepsin.



Figure B: *Trichinella* larva in pressed bear meat, partially digested with pepsin.



Figure E: Larva of *Trichinella* liberated from bear meat. This larva is from a different case than those shown in **Figures A-D**.

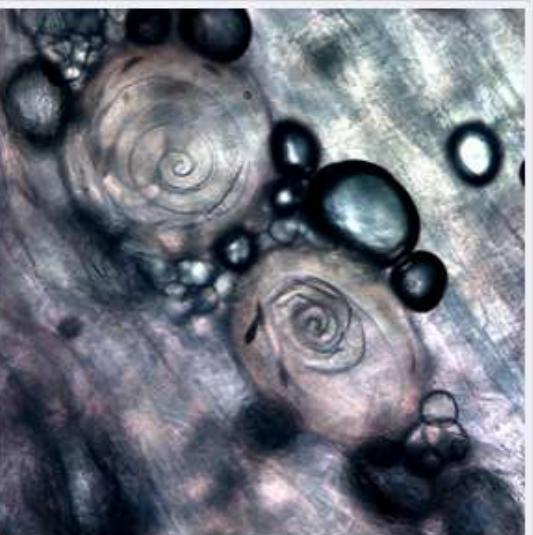


Figure C: *Trichinella* larvae in pressed bear meat, partially digested with pepsin.



Figure D: *Trichinella* larvae in pressed bear meat, partially digested with pepsin.



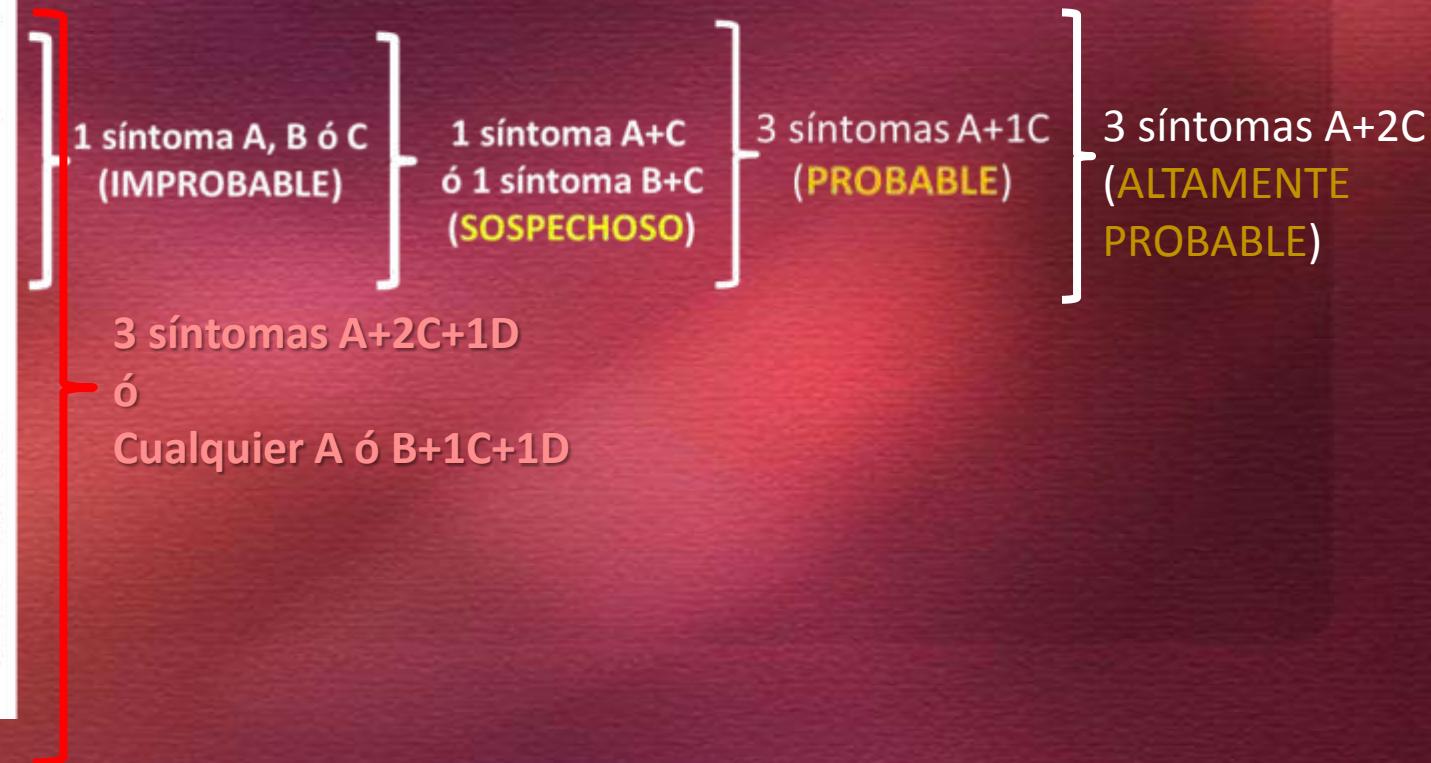
Figure F: Larva of *Trichinella* liberated from bear meat. This larva is from a different case than those shown in **Figures A-D**.

Algoritmo diagnóstico

TABLE 7. Algorithm for diagnosing acute trichinellosis in humans^a

Group	Symptom
A.....	Fever, eyelid and/or facial edema, myalgia
B.....	Diarrhea, neurological signs, cardiological signs, conjunctivitis, subungual hemorrhages, cutaneous rash
C.....	Eosinophilia (>1,000 eosinophils/ml) and/or increased total IgE levels, increased levels of muscular enzymes
D.....	Positive serology (with a highly specific test), seroconversion, positive muscular biopsy

^a Modified from reference 29 with permission of the publisher. The diagnosis is very unlikely with one symptom from group A or one from group B or C, suspected with one symptom from group A or two from group B and one from group C, probable with three symptoms from group A and one from group C, highly probable with three symptoms from group A and two from group C, and confirmed with three symptoms from group A, two from group C, and one from group D or any of group A or B, one from group C, and one from group D.



Patología

- The capsule of the infective larva is digested in the intestine since it is resistant to the gastric juice and penetrates the duodenal and jejunal mucosa, where the amount of trauma and irritation depend on the number of larvae.
- This will cause the symptoms of the enteric phase.
- After 5–7 days the worms mature and the females discharge larvae to the tissues, causing symptoms of the migratory or invasive stage.
- Later the larvae encyst, causing symptoms of the encystment stage.
- Larvae only encyst in striated muscle but travel through the brain and heart muscle, where they are unable to encyst.

Patología – Músculo estriado

- Larvae, after travelling through the circulation, encyst in muscles of the diaphragm, masseters, intercostals, laryngeal, tongue and ocular muscles.
- At first there is a basophilic degeneration of the muscle fibres followed by formation of a hyaline capsule around the larva with an inflammatory infiltrate of lymphocytes and a few eosinophils.
- Foreign body giant cells may be present.
- The infiltrate subsides and fat is deposited at the poles and after 6 months **calcification** takes place, eventually leading to death of the larva.

Músculo estriado en múltiples localizaciones

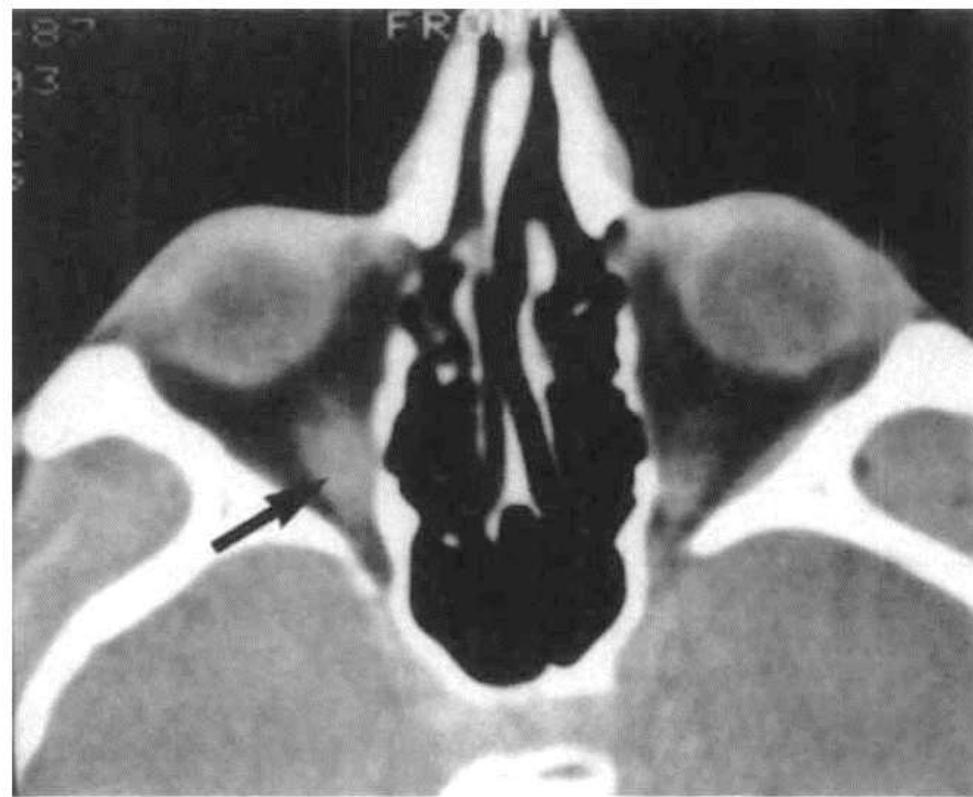


Fig. 1 (Behrens-Baumann and Freissler). Calcification (arrow) of the left inferior rectus muscle.

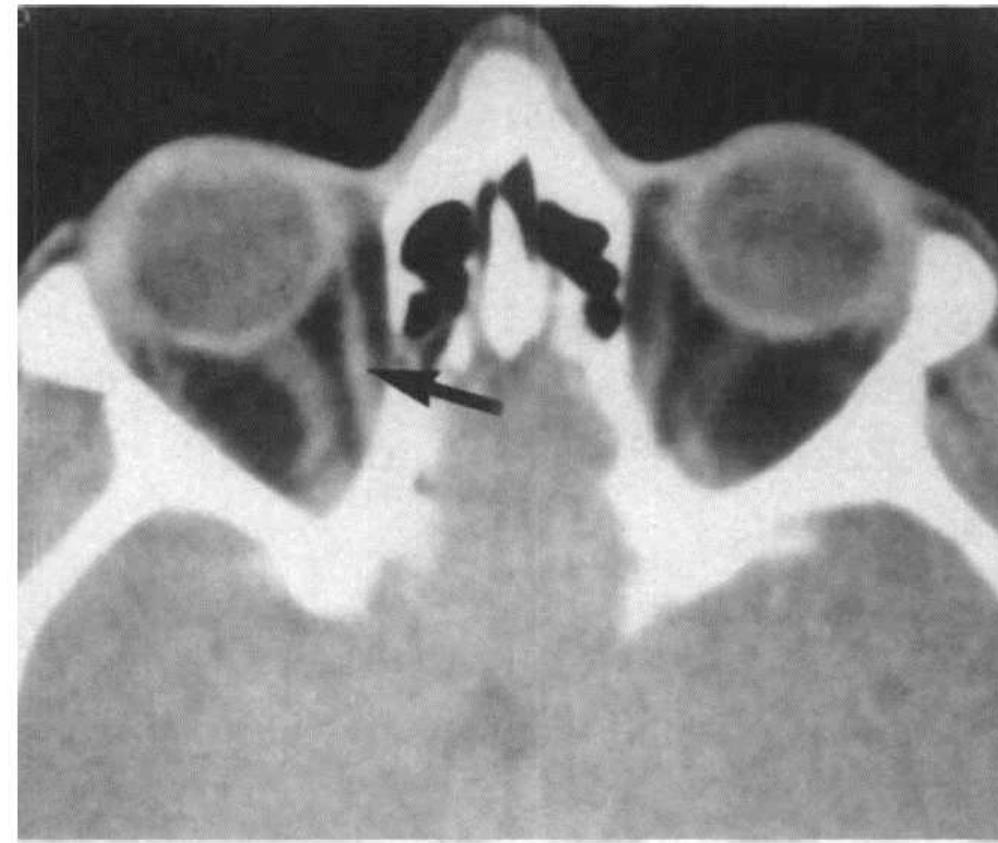


Fig. 2 (Behrens-Baumann and Freissler). Calcification (arrow) of the left medial rectus muscle.

Behrens-Baumann W, Freissler G. Computed tomographic appearance of extraocular muscle calcification in a patient with seropositive trichinosis. Am J Ophthalmol. 1990 Dec 15;110(6):709-10.

Patología – Cerebro

- Larvae migrate through the brain and meninges causing leptomeningitis, granulomatous nodules in the basal ganglia, medulla and cerebellum and perivascular cuffing in the cortex.
- They can be found in the cerebrospinal fluid with a raised cell count and increased protein.

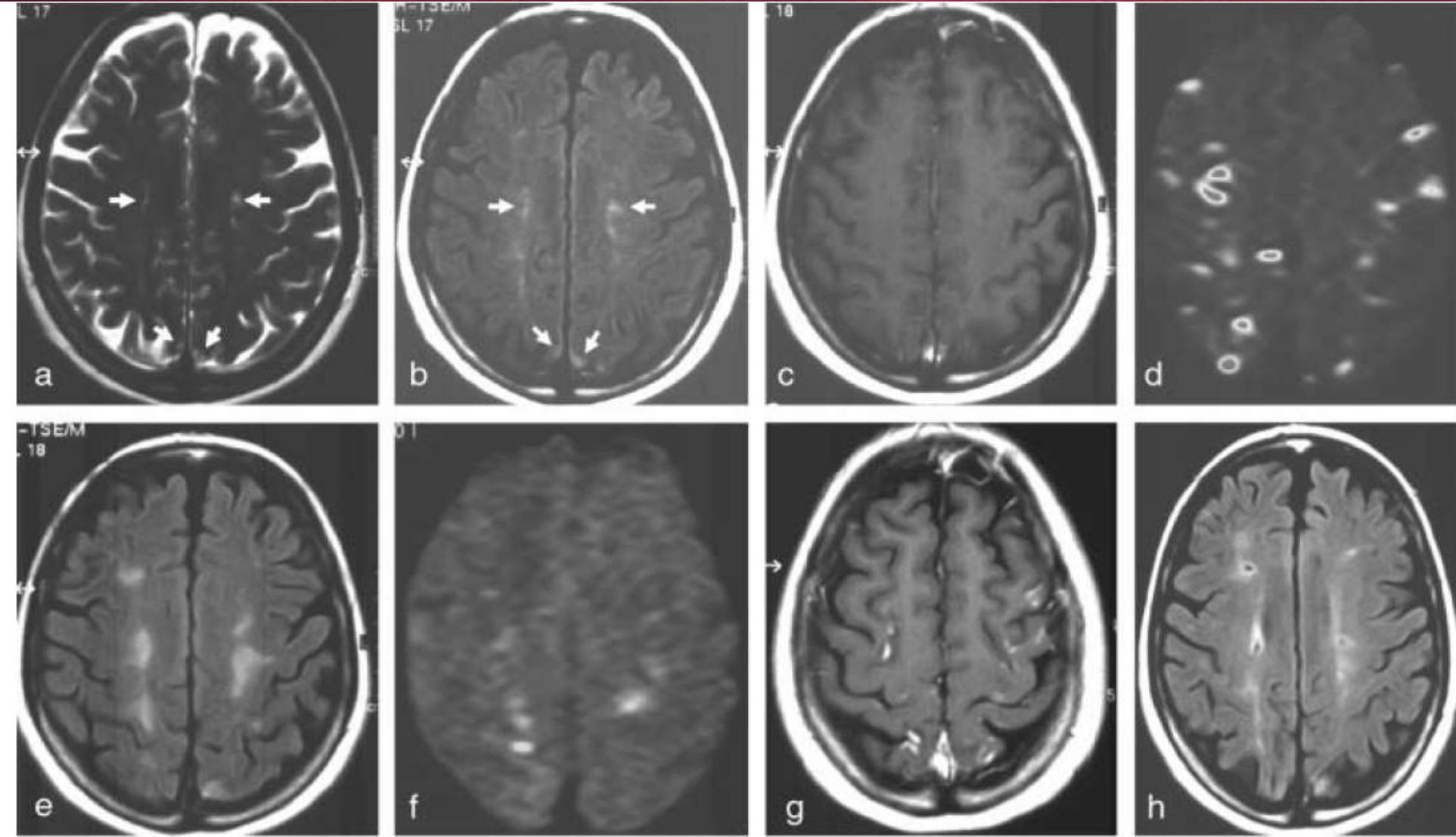


Fig. 1. Evolution of brain lesions in trichinosis. A. TSE T2W axial image at admission shows several cortical and subcortical milimetric nodular lesions with slight signal increase (arrows). B. These lesions are better seen on a TSE FLAIR T2 axial image (arrows). C. Postcontrast SE T1 axial image is normal, with no evidence of contrast enhancement. D. Isotropic diffusion-weighted (DW) image acquired at the same session reveals numerous lesions representing restricted diffusion, most of which were not present on the FLAIR T2W image. E. In a TSE FLAIR T2W axial image acquired 3 weeks later, the lesions that were evident only on DW images in the previous examination are detected with high conspicuity. F. On the DW image, many of the high signal intensity lesions seen on the first DW study disappeared, with only a few remaining. On postcontrast SE T1W image (G), slight contrast enhancement is noted in some lesions. H. Two months later, the lesions had shrunk and tiny cavities had developed within them on TSE FLAIR T2W study.

Patología – Corazón

- The larvae cause considerable damage on passage through the myocardium, cellular infiltration and necrosis with subsequent fibrosis of the myocardial bundles.



FIGURE 1. ECG at admission to the cardiology department.

An ECG was performed again at admission into the Cardiology Department, indicating widespread ST segment depression (I, II, aVF, V3–V6) and inverted T waves in III and V3–V6 (Figure 1).

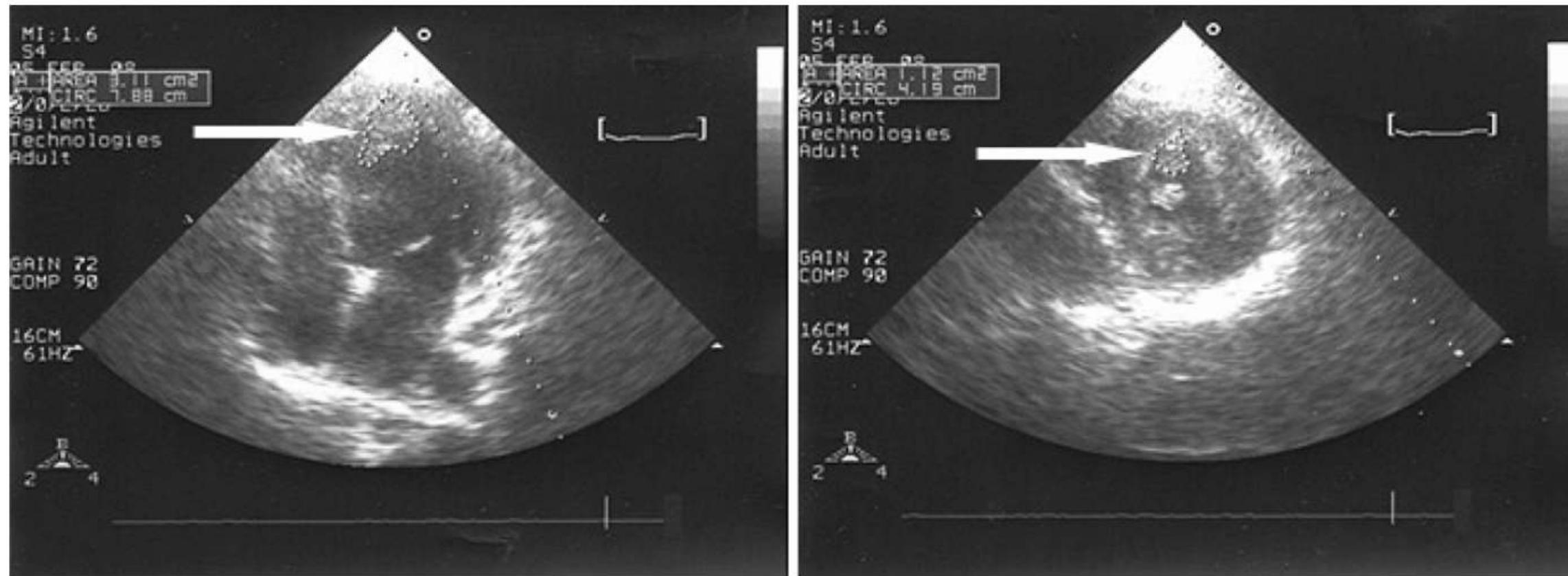


FIGURE 2. Two-dimensional cardiac echocardiogram. **Left**, Four chambers view. **Right**, Parasternal transversal view of a section at the level of papillary muscles. Thrombus presence is indicated by white arrows.

A cardiac echocardiography examination (Sonos Agilent 4500, Philips Healthcare, Best, The Netherlands) showed normal-sized cavities and a significant area of apical hypokinesis with an apical mass, highly suggestive for thrombus. No pericardial effusion was noticed (Figure 2).

Posterior al tratamiento: Enoxaparina, aspirin, prednisona y mebendazol.

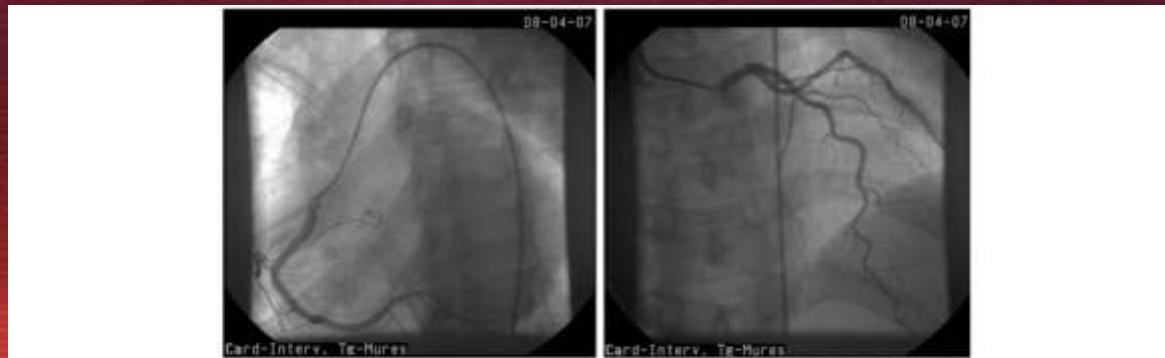


FIGURE 3. Angiographic assessment. **Right**, Normal aspect of the right coronary artery. **Left**, Normal aspect of the left main coronary artery with the left anterior descending artery and circumflex artery.

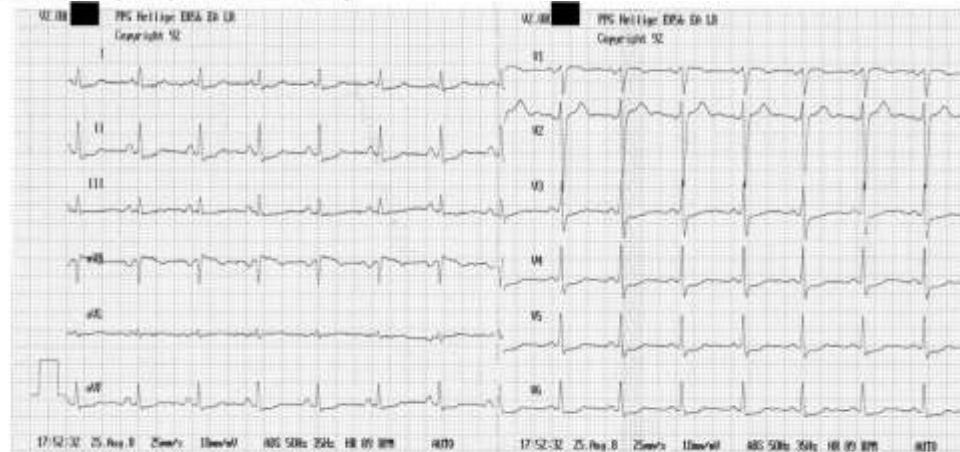


FIGURE 4. Second follow-up ECG.



FIGURE 5. Follow-up echocardiography (after 8 months) showed absence of thrombus. **Left**, Four chambers view. **Right**, Parasternal transversal view of a section at a level including papillary muscles.

Inmunidad

- In humans, a well-marked immunity to reinfection develops after the first infection but it is necessary for the infective larvae to develop through to the adult stage before immunity is produced, which is both anti-adult and antilarval.
- Cell-mediated immunity is largely responsible but humoral antibodies develop.
- Immunized mice respond rapidly to challenge infections with an inflammatory reaction in the bowel and the elimination of adult worms.
- Cellular immunity can be transferred by cellular elements and diminished by corticosteroids, adrenalectomy and whole-body irradiation.

Compromiso ocular

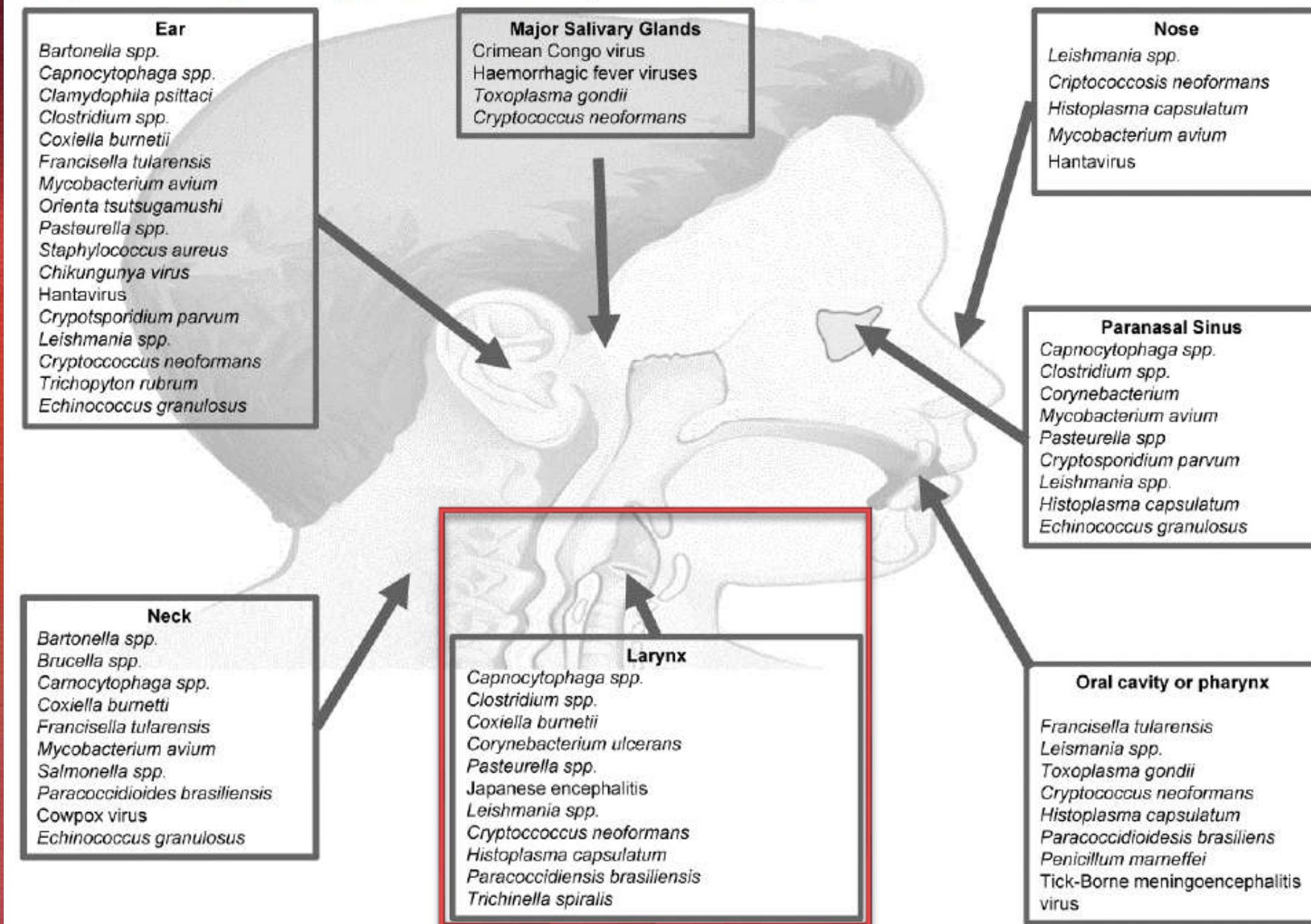
Table 1. Ocular involvement in parasitic infections²⁸

Disease	Etiologic agent	Ocular findings	Main Diagnostic Methods
<i>Round worms (nematodes)</i>			
Toxocariasis	<i>Toxocara canis</i> and <i>T. cati</i>	Peripheral white mass is often visible in affected eyes	Serology
Angiostrongyliasis	<i>Angiostrongylus cantonensis</i>	Blurred vision and poor visual acuity	Identification of <i>Angiostrongylus cantonensis</i> in the eye. Direct and indirect immunofluorescent
Onchocerciasis	<i>Onchocerca volvulus</i>	Chorioretinitis, keratitis, uveitis, corneal opacification, neovascularisation, blindness	Slit lamp, sclerocorneal punch biopsy, Xenodiagnosis
Loiasis	<i>Loa loa</i>	Conjunctival congestion and pain with movement of the eye. May affect vision transiently. Retinal hemorrhages and perivascular inflammatory	Extraction of adult worm or microfilaria
Trichinosis	<i>Trichinella spiralis</i>	Edema around the eye, conjunctivitis and exophthalmoses	Muscle biopsy
Bancroftian and Brugian filariasis	<i>Wuchereria bancrofti</i> , <i>B. malayi</i>	Retinal vasculitis, decreased vision and panuveitis with secondary glaucoma	An aqueous tap and a peripheral blood smear isolate microfilariae or adult worm
Thelaziasis	<i>Thelazia callipaeda</i>	Epiphora, conjunctivitis, keratitis, corneal opacity and ulcers	Eggs or larvae can be seen when tears or other eye secretions are examined under light microscope
Dirofilariasis	<i>Dirofilaria repens</i>	Pain, edema, and congestion of the conjunctiva, diplopia, foreign body sensation in the eye	Excision biopsy
Baylisascariasis	<i>Baylisascaris procyonis</i>	Vision loss, transient visual obscuration, and diffuse unilateral subacute neuroretinitis	Exclusion of other known causes of <i>ocular larva migrans</i>
<i>Flat worms (cestodes)</i>			
Cysticercosis	<i>Cysticercus cellulosae</i>	Subconjunctival and eyelid masses, papilloedema, cranial nerve palsies, vitritis and optic neuritis	Imaging with ultrasound, MRI and CT. Serology can be useful
Schistosomiasis	<i>Schistosoma mansoni</i> , <i>S. haemobium</i> , <i>S. japonicum</i>	Uveitis and subretinal granuloma	Eggs in the feces, urine or eggs/cercariae in the eye
Hydatid cyst	<i>Echinococcus granulosus</i>	Orbital swelling, exophthalmus and proptosis	Imaging
Fascioliasis	<i>Fasciola hepatica</i>	Painful red eye, and there may be visual defect	Adult worm in the eye
Protozoa	<i>Acanthamoeba spp</i>	Conjunctival edema, sever pain, ring infiltrate around the cornea, hypopyon, hyphema, uveitis, loss of vision	Corneal scrapings, culture
Acanthamoebic keratitis			
Chagas disease	<i>Trypanosoma cruzi</i>	Palpebral and periorbital oedema	Blood smear, Buffy coat, culture, Xenodiagnosis
Giardiasis	<i>Giardia intestinalis</i>	Salt and pepper retinal changes, chorioretinitis, retinal hemorrhage and uveitis	Diagnosing intestinal disease and exclusion
Leishmaniasis	<i>Leishmania spp</i>	Visceral: conjunctivitis, uveitis and retinal hemorrhage Cutaneous: lesions on eyelid, blepharoconjunctivitis Mucocutaneous: severe ulceration, loss of the eye	Tissue smears or biopsy, culture in NNN medium
Malaria	<i>Plasmodium falciparum</i>	Retinal hemorrhage, papilloedema, cotton wool spots	BFMP, Buffy coat, PCR, serological
Microsporidiosis	<i>Microsporidia spp</i>	Conjunctival hyperemia, punctate epithelial keratitis, hyphema, necrotizing keratitis, corneal ulcer	Corneal scrapings, biopsy, serological
Rhinosporidiosis	<i>Rhinosporidium seeberi</i>	Conjunctival granuloma	Histopathologic demonstration
Toxoplasmosis	<i>Toxoplasma gondii</i>	Congenital: Strabismus, nystagmus and blindness Acute acquired: Primarily; necrotizing chorioretinitis, vitritis is common Secondary findings include scotoma, photophobia, blindness, Glaucoma, ↑ IOP, necrotizing inflammation, loss of central vision	Serology (IgM, IgG), PCR

Buffy coat: The thin layer of concentrated white blood cells that forms when a tube of blood is spun in a centrifuge. BFMP: Blood Film for Malaria Parasite. PCR: polymerase chain reaction. NNN: Novy-MacNeal-Nicolle medium.

Compromiso ORL

Figure 1. Anatomical localization of zoonotic agents at ENT region.

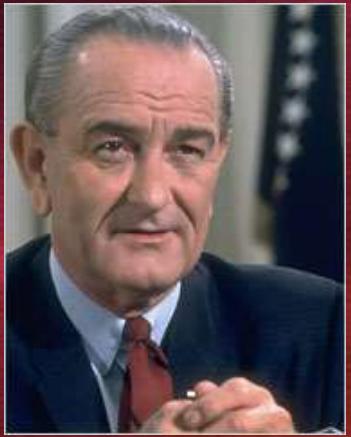


Galletti B, Mannella V, Santoro R, Rodriguez-Morales AJ, Freni F, Galletti C, Galletti F, Cascio A. Ear, nose and throat (ENT) involvement in zoonotic diseases. A systematic review.. *J Infect Dev Ctries* 2014; 8(1):017-023

Compromiso Cardíaco

TABLE 1 Parasites involving the heart according to the causative agent, geographic distribution, and usual mode of transmission

Disease	Causative agent	Geographic distribution	Mode of transmission
Chagas'disease (American Trypanosomiasis)	<i>Trypanosoma cruzi</i>	Mexico, Central and South America	Skin or mucosal entry of stools of infected <i>reduviid</i> vectors
African Trypanosomiasis	<i>Trypanosoma brucei, rhodesiense or gambiense</i>	Africa (Sudan, Angola, Congo, Uganda, Ivory Coast, Chad)	Blood transfusion
Amoebiasis	<i>Entamoeba histolytica</i>	Developing countries	Organ transplantation
Toxoplasmosis	<i>Toxoplasma gondii</i>	Worldwide	Perinatal
			Oral
			Bites of <i>Glossina (Tsetse)</i> flies
Cysticercosis	<i>Taenia solium</i>	Rural areas, poor hygiene, more prevalent in developing countries)	Fecal-oral
Echinococcosis	<i>Echinococcus granulosus</i>	Worldwide distribution (rural areas)	Ingestion of undercooked infected pork meat
Trichinellosis	<i>Trichinella spiralis</i>	Worldwide distribution	Fecal-oral
			Blood transfusion
			Perinatal
			Transplantation
			Ingestion of contaminated food with <i>Taenia solium</i> eggs (green leafs, salads)
			Ingestion of eggs from infected canids
			Ingestion of infected undercooked pork meat



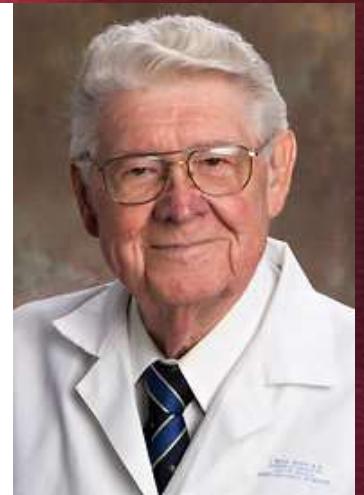
Lyndon B. Johnson
Presidente 36º de
E.U.A.

Dr. J. W. Hurst,
Cardiólogo del Presidente Johnson.
Lo atendió y trató cuando éste sufrió un infarto miocárdico.

Cardiac Manifestations of Parasitic Infections Part 1: Overview and Immunopathogenesis

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Clin. Cardiol. 30, 195–199 (2007)



TABLE 1. Epidemiology, pathogenesis, clinical manifestations, and treatment of parasitic infections that affect the heart

Parasitic infection	Causative organism	Geographic distribution	Mode of transmission	Heart involvement	Cardiac manifestation(s) ^a	Etiological treatment
Chagas' disease (American trypanosomiasis)	<i>Trypanosoma cruzi</i>	South and Central America, Mexico, and Southern United States	Vector-borne; transfusional congenital organ transplant; food borne; accidental	Myocarditis and pericarditis (acute phase); cardiomyopathy (chronic phase)	ECG changes (sinus tachycardia, first-degree atrioventricular block, low Q-R-S voltage, primary T-wave changes); cardiomegaly; pericardial effusion; heart failure; sinus node dysfunction; atrioventricular and intraventricular blocks; ventricular arrhythmias; apical aneurysm; heart failure; sudden cardiac death	Benznidazole or nifurtimox (optional, because benefit is not well established)
African trypanosomiasis (sleeping sickness)	<i>T. b. gambiense</i> , <i>T. b. rhodesiense</i>	West and Central Africa, East and Southern Africa	Vector borne; others (transfusional, congenital, and accidental are rare)	Pancarditis (within months or years after infection); pancarditis (within weeks after infection)	ECG changes (ST-T changes, low Q-R-S voltage, Q-Tc prolongation, P-R segment depression); cardiomegaly; pericardial effusion; heart failure (mild); ECG changes; cardiomegaly; pericardial effusion; heart failure (moderate to severe)	Pentamidine (early stage); melarsoprol or eflornithine (late stage); suramin (early stage); melarsoprol (late stage)
Toxoplasmosis	<i>Toxoplasma gondii</i>	Worldwide	Fecal-oral; food-borne; congenital; transfusional; organ transplant	Myocarditis and pericarditis (rare in immunocompetent individuals; more common in immunocompromised infected persons)	ECG changes; cardiomegaly; pericardial effusion; constrictive pericarditis; arrhythmias; heart failure	Pyrimethamine + sulfadiazine or pyrimethamine + clindamycin (plus folinic acid); pyrimethamine (+ azithromycin or atovaquone) for intolerant patients; pyrimethamine + sulfadiazine (pregnancy)
Cysticercosis	<i>Taenia solium</i>	Worldwide (rural areas in developing countries)	Fecal-oral	Myocarditis (very rare)	Arrhythmias; conduction abnormalities	Albendazole or praziquantel (optional because their role is still unclear)
Trichinellosis	<i>Trichinella spiralis</i>	Worldwide	Food-borne	Myocarditis and pericarditis	Arrhythmias; pericardial effusion	Albendazole or mebendazole (in conjunction with steroids for severe cases)
Amebiasis	<i>Entamoeba histolytica</i>	Worldwide (developing countries in the tropics)	Fecal-oral	Pericarditis	ECG changes; pericardial effusion; cardiac tamponade	Metronidazole
Echinococcosis	<i>Echinococcus granulosus</i>	Worldwide (rural areas)	Fecal-oral	Pericarditis; cysts anywhere in the heart	Arrhythmias; myocardial infarction; cardiac tamponade; pulmonary hypertension; sudden cardiac death	Albendazole or mebendazole

^a Q-R-S and ST-T, Q-R-S and ST-T intervals of the ECG; Q-Tc, the Q-T interval of the ECG corrected for heart rate.

Historia Natural

- Trichinosis is a self-limiting infection lasting in light infections 2–3 weeks and in heavy ones at the most 2–3 months.
- Except in heavy infections mortality is low.
- Light infections are often asymptomatic and routine examinations of diaphragms at autopsy have shown a significant number containing calcified cysts in endemic areas.

Período de Incubación

- From eating infected meat the development of symptoms during the enteric phase is up to 7 days after infection and for the migratory phase from 7 to 21 days.

Symptoms and Signs. The symptomatology depends on the level of infection and can be related to the number of larvae per gram of muscle: light infections (subclinical) up to 10 larvae, moderate 50–500 larvae and severe and possibly fatal infections more than 1000. In symptomatic cases symptoms develop in three stages: enteric (invasion of the intestine) phase, migration of the larvae (invasive phase) and a period of encystation in the muscles.

Enteric Phase. Irritation and inflammation of the duodenum and jejunum where the larvae penetrate cause nausea, vomiting, colic and sweating, resembling an attack of acute food poisoning. There may be a maculopapular skin rash, and in one-third of cases symptoms of a pneumonitis occur between the 2nd and 6th days, lasting about 5 days.

Migratory (Invasion) Phase. The cardinal symptoms and signs of this phase are severe myalgia, periorbital oedema and eosinophilia. There is difficulty in mastication, breathing and swallowing due to the involvement of the muscles and there may be some muscular paralysis of the extremities. There is a high remittent fever with typhoidal symptoms, splinter haemorrhages under the nails and in the conjunctivae and blood and albumin in the urine. Characteristically, there is a hypereosinophilia from the 14th day which decreases after a week and persists at a lower level. An absence of eosinophilia denotes a poor prognosis. The lymph glands may be enlarged as well as the parotid and submental glands. Occasionally, there is splenomegaly. In severe cases, there may be subpleural, gastric and intestinal haemorrhages.

Rarely, myocardial complications can occur¹⁹³ and in 10–20% of patients neurological complications when larvae pass through the central nervous system.¹⁹⁴

Encystment Phase. This is the third stage and may be severe. There may be cachexia, oedema and extreme dehydration. During the 2nd month after infection there is a decrease in muscle tenderness, fever and itching subside and congestive heart failure may appear. Damage to the brain may persist with protean neurological signs which may clear up later or persist. Gram-negative septicaemia from organisms introduced by the larvae, permanent hemiplegia and Jacksonian epilepsy 10 years after an attack of trichinosis, have been described.

Diagnóstico histológico

Clinical Microbiology Reviews, Jan. 2009, p. 127–145

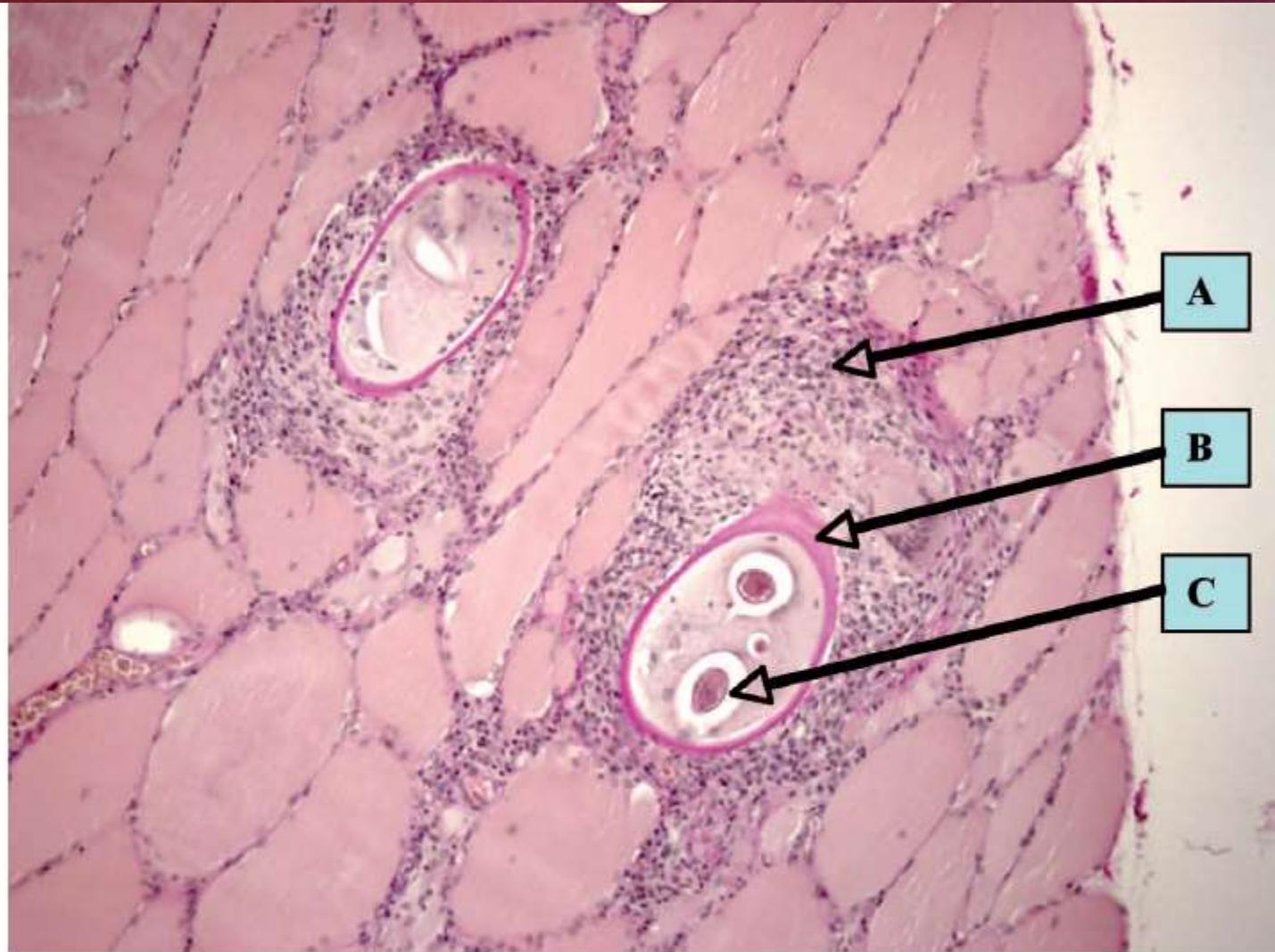


FIG. 4. Histological section (hematoxylin-eosin staining) of a muscle biopsy from a patient involved in a trichinellosis outbreak (100). (A) Cellular infiltrates; (B) collagen capsule of a “nurse cell”; (C) intersected muscle larva. (Photograph courtesy of Dietrich-Bonhoeffer-Klinikum, Neubrandenburg, Germany.)

Diagnóstico

- Clínico-epidemiológico
- Histopatológico
- Xenodiagnóstico
- Métodos inmunológicos
- Métodos moleculares

Diagnóstico

- Clínico-epidemiológico
- Histopatológico
 - Sangre: larvas en sangre periférica (estadios tempranos de la fase de migración) (ácido acético+centrifugación)
 - Músculo: triquinoscopia (fase enquistamiento, 7 días postinfección)
 - Deltoides, biceps, gastrocnemius or pectoralis major digerido en pepsin al 1% y ácido hidroclorídico al 1% por muchas horas a 37°C, filtrado o centrifugado y el número de larvas por gramo (lpg) puede ser estimado.
 - Las larvas pueden ser vistas en músculo entre 2 láminas, más útil en las 3 primeras semanas de la enfermedad.
- Xenodiagnóstico
- Métodos inmunológicos
- Métodos moleculares

Diagnóstico

- Clínico-epidemiológico
- Histopatológico
- Xenodiagnóstico
 - Alimentando ratas blancas albinas no infectadas con tejido diafragmático y examinándolo un mes luego.
- Métodos inmunológicos
- Métodos moleculares

Diagnóstico

- Clínico-epidemiológico
- Histopatológico
- Xenodiagnóstico
- Métodos inmunológicos
 - Immunofluorescencia indirecta
 - Inmunohistoquímica
 - ELISA
 - Microfluorescencia
 - Quimioluminiscencia
 - DELFIA (Dissociated Enhanced Lanthanide FluorolImmunoAssay) (>sensible)
 - Western blot test.
- Métodos moleculares : PCR

Manejo Clínico

TABLE 8. Practical recommendations to handle clinical trichinellosis cases^a

Severity code	Recommendation for treatment
Severe and moderately severe diseases.....	Hospitalization is compulsory for severe forms and debatable for moderately severe forms Administration of anthelmintics (albendazole or mebendazole) Monitoring of the pharmacokinetics of anthelmintics (if possible) Administration of glucocorticosteroids (e.g., prednisolone), always with anthelmintics Compensation of fluid and electrolyte deficits Administration of pain killers
Benign, abortive, and asymptomatic diseases.....	Administration of anthelmintics (albendazole or mebendazole) Administration of nonsteroidal anti-inflammatory drugs if necessary

^a Modified from reference 29 with permission of the publisher.

Tratamiento



Drug	Adult and pediatric dose
Albendazole	400 mg twice a day by mouth for 8 to 14 days
Mebendazole	200 to 400 mg three times a day by mouth for 3 days, then 400 to 500 mg three times a day by mouth for 10 days

Prevención y Control

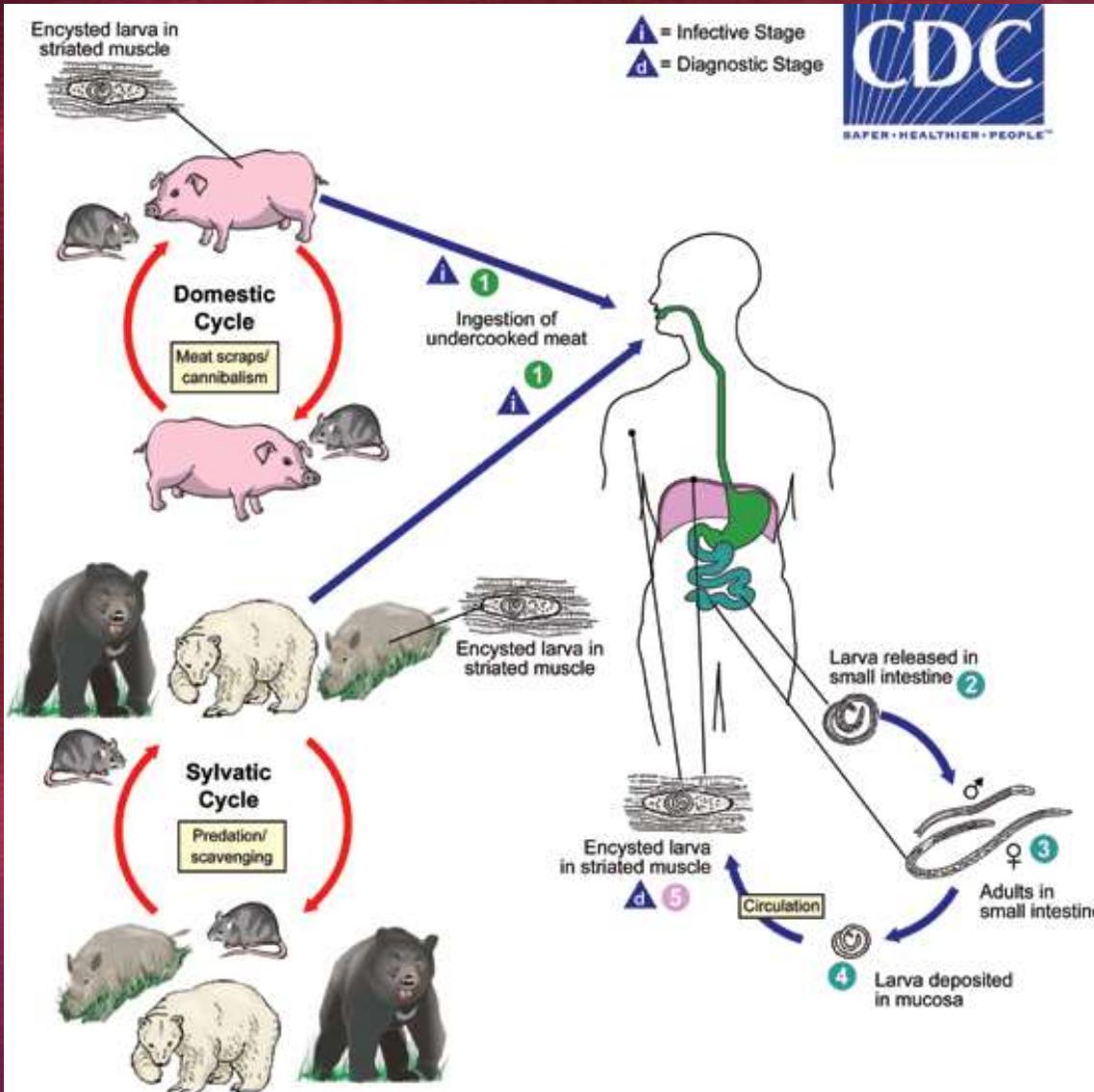
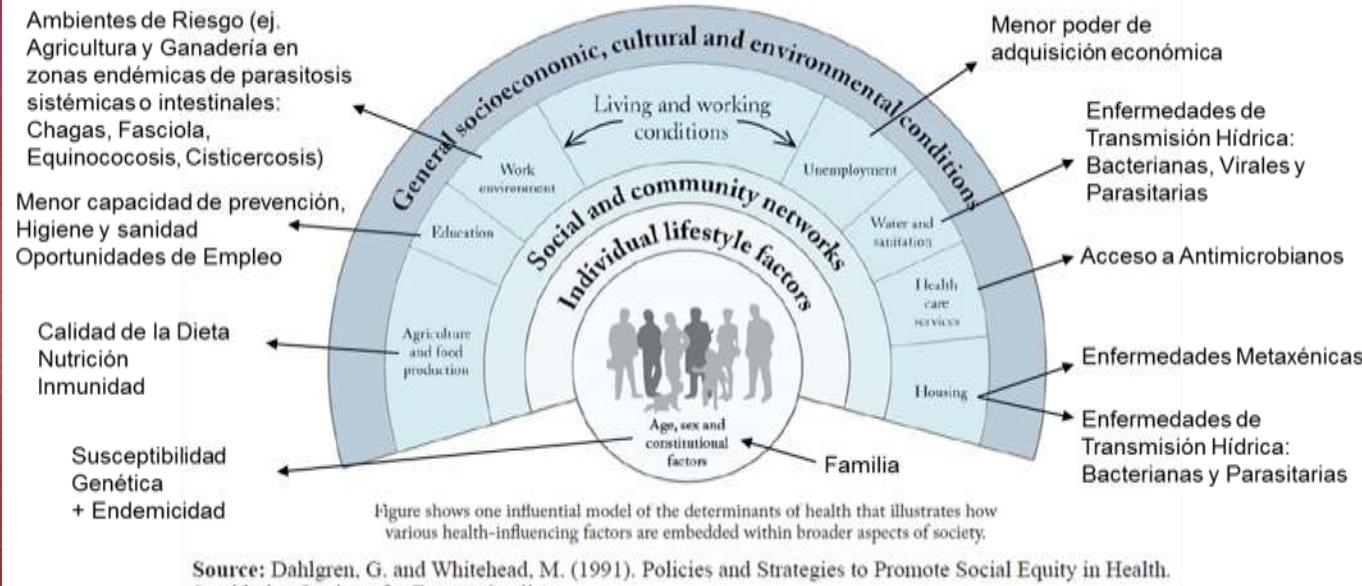


Figure 1.1 A Model of the Determinants of Health



Source: Dahlgren, G. and Whitehead, M. (1991). Policies and Strategies to Promote Social Equity in Health. Stockholm: Institute for Futures Studies.

Control Veterinario - Mataderos

TABLE 2. Predilection sites for *Trichinella* larvae in different animal species^a

Animal species	Predilection sites	Aim of examination
Domestic swine	Diaphragm, tongue, masseter	Meat inspection (domestic animals)
Horse	Tongue, masseter	Meat inspection (domestic animals)
Wild boar	Forearm, diaphragm, tongue	Meat inspection (game)
Bear	Diaphragm, masseter, tongue	Meat inspection (game)
Walrus seal	Tongue, diaphragm, flippers, masseter	Meat inspection (game)
Fox	Diaphragm, forearm muscles, tongue	Epidemiological studies (reservoir animals)
Raccoon dog	Diaphragm, forearm muscles, tongue	Epidemiological studies (reservoir animals)

^a Based on data from references 49, 66, and 70.

TABLE 3. Relationship between time of seroconversion and infection dose (*T. spiralis*) in pig, horse, wild boar, and red foxes

Animal species	Infection dose (no. of larvae/animal)	No. of lpg	Time of seroconversion p.i. (wk)
Swine	100	1.62–6.50 ^b	5–7
	500	18.4–48.6 ^b	4–5
	1,000	26.3–90.6 ^e	4–6
	2,500	87.6–99.5 ^b	4
	8,000	12.1–81.4 ^c	3
	20,000	699.2–1103.5 ^e	3–4
	64,000	221.4–466.6 ^c	2.5–3
Horse	1,000	0.10–0.26 ^b	3–4
	4,000	0.39–7.8 ^b	3–7
	5,000	0.02–8.9 ^e	2–4.5
	10,000	6.6–60.0 ^b	3–4
	40,000	484–1060 ^d	2–3
Wild boar	10,000	43–100 ^e	3–4
Red fox	10,000	7.7–202.7	3

^a Data for pig based on references 46, 104, and 152; data for horse based on references 47 and 157; data for wild boar based on reference 67; and data for red foxes based on reference 91.

^b Mean of tongue.

^c Mean of tongue, masseter, diaphragm, intercostal, psoas, and rectus abdominis.

^d Mean of masseter.

^e Mean of diaphragm.

Conclusiones

- ❖ Patología de gran importancia, la cual a pesar de su frecuencia, no es objeto de vigilancia epidemiológica en Colombia y en otros países
- ❖ Alta frecuencia en población inmunosuprimida
- ❖ Clínicamente, pensar en los diagnósticos diferenciales, pero también en presentaciones atípicas que pueden complicarse, e incluso ser fatales
- ❖ Necesidad de incrementar la investigación epidemiológica en la región y el país

