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Original Article

Laboratory-Acquired Parasitic Infections and Biosafety

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Abstract

In recent years, due to the increase of the population of global travelers, immigrants and immunocompromised individuals, parasitic diseases are receiving increasing attention in many countries. It is essential for laboratory and health care workers to learn about the most frequent parasitic laboratory infection accidents, types of exposure and transmission route, potential biosafety risks and the preventive measures. We review the laboratory-acquired parasitic infections (LPI) reported in the literature during 1976–2015 and find a total of 319 cases. Among them, blood and tissue protozoa constitute 74.6% and are the most frequent LPI, followed by intestinal protozoa (16.0%) and helminthes (9.4%). Accidents of blood and tissue protozoa infections are mostly caused by needle or sharp injuries, wound contact or arthropod bites. Accidents of intestinal protozoa and helminthes infections are majorly caused by accidental ingestion, inoculation or mucosal contact.

Keywords: Parasite, Arthropod vectors, Biosafety levels, Arthropod containment levels, Laboratory-acquired infections, Biosafety accidents

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Laboratory-Acquired Fungal Infections and Biosafety

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Abstract

In recent years, due to the increase of global migration, climate and environmental change, and immunocompromised population, highly pathogenic and opportunistic fungal diseases are receiving increasing concern in many countries. Hence, it is necessary for laboratory and health care workers to learn about the most frequent fungal laboratory infection accidents, their exposure and transmission routes, as well as potential biosafety risks and the preventive measures. We review laboratory-acquired fungal infections (LFIs) reported in the literature during 1959–2015 and find a total of 398 cases. Among them, dermatophytes constitutes 40.5% and is the most frequent LFIs and occurred mostly in animal experiments. Regarding accidents of handling clinical specimens or fungal culture, the risk group 3 (RG3) dimorphic fungi are the major causative agents, such as *Coccidioides* spp. (*C. immitis* or *C. posadasii*) constituting 28.9%, *Histoplasma capsulatum* 20.8%. RG2 dimorphic fungi such as *Sporothrix schenckii* (3.8%), *Blastomyces dermatitidis* (3.5%), and *Penicillium marneffei* (0.5%), are also major LFI pathogens. In yeast, *Cryptococcus neoformans* consisted 2.0% of total LFIs. Infection routes of LFI include animal contacts, needle/sharp injuries, airway inhalation of conidia or infectious aerosol and wound or mucosal contacts etc. In order to protect laboratory workers from getting infected, culturing of the mold form of RG3 dimorphic fungi or handling specimens containing conidia should be done under biosafety level 3(BSL–3) or class III biological safety cabinet(class III BSC) environment; animal infection experiment with RG3 fungi should be conducted in animal biosafety level 3(ABSL–3) facilities; other experiments dealing with samples containing viable fungi should be done in BSL–2 or class II BSC environment. Personal protective equipment should be worn during laboratory experiments. Washing hands and decontamination and disinfection of and laboratory environment are needed after experiments are done.

Keywords: Fungi, Yeast, Mold, Dimorphic fungi, Biosafety levels, Laboratory-acquired infections, Biosafety accidents

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Numbers of New Cases and Cumulative Cases of Notifiable Infectious Diseases （by week of diagnosis）

Case diagnosis week		Week 16		Week 1—17	
Classification	Disease Diagnosed[1]	2016	2015	2016	2015
Category I	Plague	0	0	0	0
	Rabies	0	0	0	0
	SARS	0	0	0	0
	Smallpox	0	0	0	0
Category II	Acute Flaccid Paralysis	4	0	13	6
	Acute Viral Hepatitis type A	10	2	200	26
	Amoebiasis	2	5	78	112
	Anthrax	0	0	0	0
	Chikungunya Fever	1	0	4	3
	Cholera	0	0	0	0
	Dengue Fever	9	5	524	192
	Diphtheria	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	1	0	3	0
	Malaria	0	0	4	3
	Measles	1	0	2	1
	Meningococcal Meningitis	0	0	2	1
	Paratyphoid Fever	0	0	0	3
	Poliomyelitis	0	0	0	0
	Rubella	1	0	4	3
	Shigellosis	7	1	68	69
	Typhoid fever	0	0	1	12
	West Nile Fever	0	0	0	0
Category III	Acute Viral Hepatitis type B	1	2	26	34
	Acute Viral Hepatitis type C[5]	6	3	58	61
	Acute Viral Hepatitis type D	0	0	1	1
	Acute Viral Hepatitis type E	2	0	6	1
	Acute Viral Hepatitis untype	0	0	0	0
	Congential Rubella Syndrome	0	0	0	0
	Enteroviruses Infection with Severe Complications	0	0	3	1
	Haemophilus Influenza type b Infection	1	0	3	1
	Japanese Encephalitis	0	0	0	0
	Legionellosis	3	1	34	51
	Mumps[2]	9	22	164	233
	Neonatal Tetanus	0	0	0	0
	Pertussis	1	2	3	46
	Tetanus[2]	0	0	2	1
Category IV	Botulism	0	0	1	1
	Brucellosis	0	0	0	0
	Complicated Influenza	17	27	1792	324
	Complicated Varicella[4]	0	0	13	20
	Endemic Typhus Fever	0	0	3	1
	Herpesvirus B Infection	0	0	0	0
	Invasive Pneumococcal Disease	11	7	254	215
	Leptospirosis	1	0	13	17
	Lyme Disease	0	0	0	0
	Melioidosis	1	0	5	10
	Q Fever	1	2	9	12
	Scrub Typhus	2	1	72	99
	Toxoplasmosis	0	0	5	1
	Tularremia	0	0	0	0
Category V	Ebola Virus Disease	0	0	0	0
	Ebola-Marburg Hemorrhagic Fever	0	0	0	0
	Novel Influenza A Virus Infections[6]	0	0	0	0
	Lassa Fever	0	0	0	0
	Rift Valley Fever	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0
	Yellow Fever	0	0	0	0

1. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
2. Reported cases.
3. Since 2014/1/1, "Varicella" was modified to "Complicated Varicella".
4. Since 2014/3/6, the case definition for confirmed Acute hepatitis C was changed from "meet the clinical and laboratory conditions" to "meet the clinical or laboratory conditions".
5. Since 2014/7/1, various subtypes of human cases of avian influenza are reported as "novel influenza A virus infections", a Category V Notifiable Infectious Disease. The original "H5N1 flu" and "H7N9 flu", which were respectively listed as a Category I Notifiable Infectious Disease and a Category V Notifiable Infectious Disease were removed from the list on the same day.

Suspected Clusters

●Twenty-three clusters were reported, including 16 diarrhea clusters, 2 tuberculosis clusters, 2 influenza-like illness clusters, 2 varicella clusters and 1 upper respiratory tract infection cluster.

Imported Infectious Diseases

●15 confirmed cases were imported from 6 countries during Week 16 of 2016.

Country / Disease	Indonesia	Brazil	Papua New Guinea	Maldives	China	Vietnam	Total
Dengue Fever	6		1	1			8
Shigellosis	3						3
Measles						1	1
Amoebiasis	1						1
Chikunguny a Fever		1					1
Hepatitis E					1		1
Total	10	1	1	1	1	1	15

Note: The statistics listed in this table include imported cases that were either confirmed or updated★ in the previous week.

●A total of 195 confirmed cases were imported from 21 countries in 2016.

●Top 3 imported diseases：Dengue fever (91), Amoebiasis (33), Shigellosis (31).

●Top 3 countries responsible for most imported cases：Indonesia (95), Philippines (20), Vietnam (16).

Summary of Epidemic

●**Enterovirus**：As the enterovirus activity has been increasing continuously, the epidemic season is about to start. During Week 16, 2 cases of enterovirus 71 infection, including one severe case and one mild case, have been confirmed. The public is urged to enhance personal hygiene and stay vigilant for suspicious symptoms of enterovirus infection with severe complications in infants.

●**Dengue Fever**：One new case was confirmed in Kaohsiung City. Imported cases have continuously been reported. The recent average temperature in southern Taiwan is 28℃, which favors mosquito growth. The public is urged to clean up and remove any vector breeding sites and take prevention measures against mosquito bites.

Numbers of New Cases and Cumulative Cases of Notifiable Infectious Diseases （by week of diagnosis）

Case diagnosis week		Week 17		Week 1—17	
Classification	Disease Diagnosed[1]	2016	2015	2016	2015
Category I	Plague	0	0	0	0
	Rabies	0	0	0	0
	SARS	0	0	0	0
	Smallpox	0	0	0	0
Category II	Acute Flaccid Paralysis	0	0	13	6
	Acute Viral Hepatitis type A	14	0	213	26
	Amoebiasis	5	6	83	118
	Anthrax	0	0	0	0
	Chikungunya Fever	0	0	4	3
	Cholera	0	0	0	0
	Dengue Fever	4	4	528	196
	Diphtheria	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	3	0
	Malaria	0	0	4	3
	Measles	0	0	2	1
	Meningococcal Meningitis	0	0	2	1
	Paratyphoid Fever	0	0	0	3
	Poliomyelitis	0	0	0	0
	Rubella	0	1	4	4
	Shigellosis	8	1	76	70
	Typhoid fever	0	0	1	12
	West Nile Fever	0	0	0	0
Category III	Acute Viral Hepatitis type B	3	4	29	38
	Acute Viral Hepatitis type C[5]	5	10	63	71
	Acute Viral Hepatitis type D	0	0	1	1
	Acute Viral Hepatitis type E	0	0	6	1
	Acute Viral Hepatitis untype	0	0	0	0
	Congential Rubella Syndrome	0	0	0	0
	Enteroviruses Infection with Severe Complications	1	0	4	1
	Haemophilus Influenza type b Infection	0	0	3	1
	Japanese Encephalitis	0	0	0	0
	Legionellosis	0	2	34	53
	Mumps[2]	9	20	173	253
	Neonatal Tetanus	0	0	0	0
	Pertussis	3	0	6	46
	Tetanus[2]	1	0	3	1
Category IV	Botulism	0	0	1	1
	Brucellosis	0	0	0	0
	Complicated Influenza	19	22	1811	346
	Complicated Varicella[4]	2	1	15	21
	Endemic Typhus Fever	0	0	3	1
	Herpesvirus B Infection	0	0	0	0
	Invasive Pneumococcal Disease	14	12	268	227
	Leptospirosis	1	2	14	19
	Lyme Disease	0	0	0	0
	Melioidosis	0	1	5	11
	Q Fever	2	2	11	14
	Scrub Typhus	2	3	74	102
	Toxoplasmosis	0	2	5	3
	Tularremia	0	0	0	0
Category V	Ebola Virus Disease	0	0	0	0
	Ebola-Marburg Hemorrhagic Fever	0	0	0	0
	Novel Influenza A Virus Infections[6]	0	0	0	0
	Lassa Fever	0	0	0	0
	Rift Valley Fever	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0
	Yellow Fever	0	0	0	0

1. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
2. Reported cases.
3. Since 2014/1/1, "Varicella" was modified to "Complicated Varicella".
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5. Since 2014/7/1, various subtypes of human cases of avian influenza are reported as "novel influenza A virus infections", a Category V Notifiable Infectious Disease. The original "H5N1 flu" and "H7N9 flu", which were respectively listed as a Category I Notifiable Infectious Disease and a Category V Notifiable Infectious Disease were removed from the list on the same day.

Suspected Clusters

●Eighteen clusters were reported, including 6 diarrhea clusters, 4 upper respiratory tract infection clusters, 4 tuberculosis clusters, 2 varicella clusters, 1 influenza-like illness cluster, and 1 fever of unknown origin cluster.

Imported Infectious Diseases

●14 confirmed cases were imported from 7 countries during Week 17 of 2016.

Country / Disease	India	Indonesia	Japan	China	Mozambique	Malaysia	Cambodia	Total
Hepatitis A			2	1		1		4
Shigellosis	2	1						3
Amoebiasis		2						2
Dengue Fever							1	1
Malaria					1			1
Rubella	1							1
Q Fever				1				1
Hepatitis E	1							1
Total	4	3	2	2	1	1	1	14

Note: The statistics listed in this table include imported cases that were either confirmed or updated★ in the previous week.

●A total of 209 confirmed cases were imported from 22 countries in 2016.

●Top 3 imported diseases：Dengue fever (92), Amoebiasis (35), Shigellosis (34).

●Top 3 countries responsible for most imported cases：Indonesia (98), Philippines (19), Vietnam (16).

Summary of Epidemic

●**Enterovirus**：As the enterovirus activity has been increasing continuously, the epidemic season has begun and the number of visits to outpatient services and ER last week was higher than the epidemic threshold. This year, a total of 20 cases of enterovirus 71 infection, including 3 severe cases and 17 mild cases, have been confirmed. The public is urged to enhance personal hygiene and stay vigilant for suspicious symptoms of enterovirus infection with severe complications in infants.

●**Dengue Fever**：Imported cases have continuously been reported. The recent average temperature in southern Taiwan is over 25℃, which favors mosquito growth. The public is urged to clean up and remove any vector breeding sites and take prevention measures against mosquito bites.

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