TROPICAL MEDICINE FOR THE PULMONOLOGIST(MALARIA,HYDATID DISEASE,AMOEBIASIS,LEPTOSPIROSIS)

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MALARIA

INTRODUCTION

- Malaria remains a major public health problem in endemic areas.
- Responsible for 1.5 to 2.7 million deaths each year worldwide.
- Tropical African countries are estimated to contribute >90% of the total malaria incidence and great majority of malarial deaths.
- Respiratory tract involvement ranging from upper respiratory symptoms to ARDS is seen in 3-10% cases.
- Incidence of pulmonary edema was around 1per 1000 cases in a large study from vietnam.

SEVERE MALARIA

Definition:Presence of P.falciparum asexual parasitaemia and no other obvious cause of their symptoms,the presence of one or more of the following clinical/laboratory features is classified as severe malaria

- CLINICAL:

a) Prostration
b) Impaired consciousness
c) Respiratory distress(acidotic breathing)
d) Multiple convulsions
e) Circulatory collapse
f) Pulmonary edema
g) Abnormal bleeding
h) Jaundice
i) Hemoglobinuria

- LAB:

a) Severe anaemia
b) Hypoglycemia
c) Acidosis
d) Renal impairment
e) Hyperlactataemia
f) hyperparasitaemia

COMPARISON BETWEEN LEPTOSPIROSIS,MALARIA AND DENGUE

Clinical difference	Leptospirosis	Malaria	dengue
Splenomegaly	+	++	+ or -
Subconjunctival hemorrhage	Classically present	Can be present Rare	Can be present
Myalgia	Classically present	Usually present	Can be present
Hemoptysis	Common	Uncommon	Uncommon
Encephalopathy	Uncommon	Common	Uncommon
Abdominal pain	Common	Uncommon	Uncommon
Arthralgia	Less common	Uncommon	common

COMPARISON BETWEEN LEPTOSPIROSIS,MALARIA AND DENGUE

Lab difference	Leptospirosis	Malaria	Dengue
Hemoglobin	Normal unless bleeding	Anemia	Elevated/normal unless bleeding
TLC	Leucocytosis	Usually normal,leucocytosis can be present Increased TLC bad prognostic sign	Normal/leucopenia
Potassium levels	Hypokalemia common Hyperkalemia poor prognostic	Hyperkalemia(IV hemolysis/ ARF) /hypokalemia	Normal/raised/reduced
DIC	Uncommon	Common	Common
P.S	Left shift	Malarial parasite	Atypical lymphocyte
Hypoglycemia	Uncommon	Common	Uncommon
Pulmonary involvement	Pulmonary hemorrhage ARDS Pnuemonia Diffuse nodular shadows Cardiogenic pulmonary edema	ARDS Fluid overload Pulmonary sequestration due to parasite	Less common ALI/ARDS
ABG	Normal anion gap,acidosis more common	High anion gap metabolic acidosis(lactic)	Lactic acidosis less common
Ascites / bilateral pleural effusion	Absent	Absent	Present
Myocarditis	Common	Less common	Less common

HOW COMMON IS MALARIA AS CAUSE OF ARDS?

Etiological causes and outcomes in 102 patients of acute respiratory distress syndrome admitted to the Respiratory Intensive Care Unit at the authors' institution

	Number of patients	Mortality (%)
Infective		
Severe pneumonia	27	51.8
Sepsis[a]	25	52.0
Malaria	7	42.9
Enteric fever	1	0
"Viral" syndrome	4	25.0
Direct tracheobronchial injury		
Aspiration	8	50.0
Drowning	4	25.0
Toxic fume inhalation	2	100
Miscellaneous		
Fat embolism	4	0
Pancreatitis	10	50.0
Postoperative complications	3	33.3
Paraquat poisoning	2	100
Others[b]	5	60.0

PATHOGENESIS OF ALI/ARDS IN MALARIA

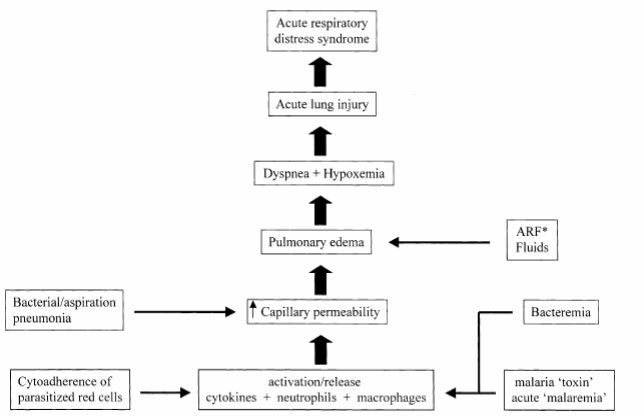
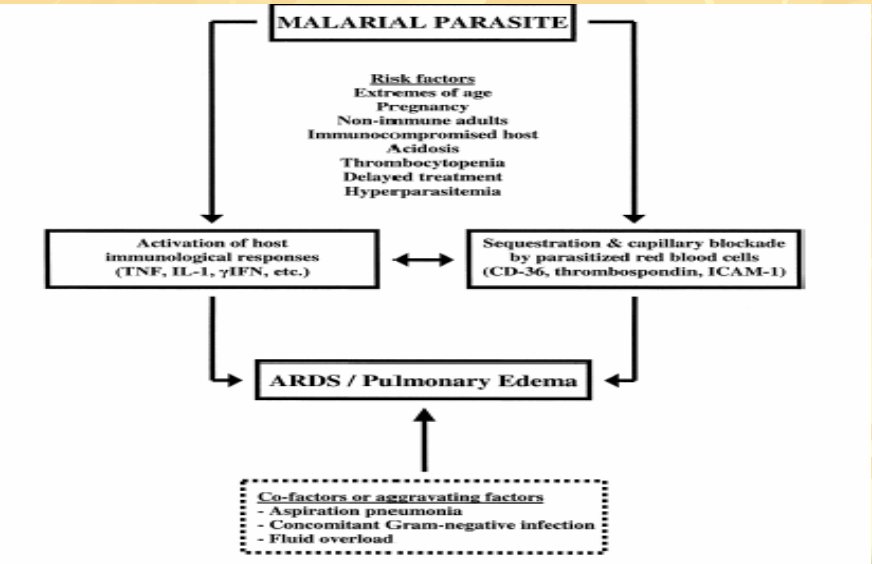


Fig. 2. Schematic summary of the possible pathophysiologic steps of malaria-related ALI and ARDS. ARF*=acute renal failure.

PATHOGENESIS OF ARDS AND PULMONARY EDEMA IN MALARIA



DIFFERENTIAL DIAGNOSIS OF HYPOXEMIA IN MALARIA

1) ARDS
2) Fluid overload
3) Aspiration pneumonia
4) Gram negative bacteremia
5) Sequestration of parasitised RBCs in pulmonary vasculature

BACTERIAL SUPERINFECTION IN MALARIA

- Both community acquired as well as nosocomial infections are common.
- Mechanism:
- 1)Transient immunosuppression.
- 2)Impaired splanchnic perfusion-translocation of gut bacteria.
- Most common infection is aspiration pneumonia.
- Recommendation:-Empirical antibiotics in severely ill patients without delay.

COMMUNITY ACQUIRED BACTERIAL INFECTIONS IN SEVERE MALARIA

PARAMETER	SEVERE MALARIA(n=93)	LESS SEVERE MALARIA
Number of episodes	13(14%)	6(6%)
Number of patients	13(14%)	6(6%)
Site of infection	17	6
Pneumonia	6	1
Bacteremia	5	1
Urinary tract infection	3	1
Miscellaneous	3	3

AJRCCM 2003;167;684-689

LAB DIAGNOSIS OF MALARIA

METHOD	ADVANTAGE	DISADVANTAGE
1) Thick blood film	·Sensitive(0.001% parasitemia) ·Species specific. ·Inexpensive.	·Requires experience. ·Underestimates true count.
2)Thin blood film	·Rapid ·Species specific. ·Provides prognostic information in severe malaria.	·Insensitive (>0.05% parasitemia). ·Uneven distribution of P.vivax.
3)PFHRP2 dipstick or card test	·Rapid ·Sensitivity similar to or slightly less than thick film (>0.001% parasitemia).	·Detects only P.falci. ·Remains +ve after weeks of infection. ·Does not give quantitative analysis.
4) Plasmodium LDH dipstick or card test	·Rapid ·Sensitivity similar to PFHRP2dipstick. ·Less sensitive diagnosis for P.vivax,malarie and ovale.	·Slightly more difficult than PFHRP2. ·Miss low levels of parasitemia with other malarias. ·Does not provide quantitative analysis.
5)Membrane concentration methods with acridine orange staining	·Sensitivity similar or superior to that of thick films (~ 0.001% parasitemia). ·Ideal for processing large no. of samples rapidly.	·Does not specify or quantitate. ·Requires fluorescence microscopy.

PROGNOSTIC MARKERS IN MALARIA

PARAMETER	SURVIVORS (n=83)	NONSURVIVORS (n=10)	P VALUE
Unrousable coma,n(%)	25(30)	9(90)	<0.001
Severe anaemia,n(%)	7(8)	1(10)	1
Renal failure,n(%)	40(48)	7(70)	0.3
Pulmonary edema,n(%)	5(6)	5(50)	<0.001
Hypoglycemia,n(%)	3(4)	0	1
Shock,n(%)	12(15)	8(80)	<0.001
Bleeding/DIC,n(%)	19(23)	3(30)	0.7
Seizures,n(%)	2(2)	0	1
Acidosis,n(%)	11(13)	8(80)	<0.001
Coma and acidosis,n(%)	2(2)	8(80)	<0.001
Coma and shock,n(%)	3(4)	8(80)	<0.001
Parasitemia of more than 5%,n(%)	32/79(41)	7/9(78)	0.07

TREATMENT OF SEVERE FALCIPARUM MALARIA

Trial	No. of patients	Drugs	Results	Reference
(SEAQUAMAT)	1461	Artes(730) Vs. Quin(731)	34.7% absolute mortality	*Lancet 2005; 366: 717–25*
Wellcome Trust Clinical Research Unit	560	Artem(284) Vs. Quin(276)	Faster Parasite clearance	*N Engl J Med. 1996 Jul 11;335(2):76-83.*
Faculty of Tropical Medicine, Mahidol University	131	Artes Vs. Quin	Faster Parasite clearance, mortality	*Clin Infect Dis. 2003 Jul 1;37(1):7-16*
Faculty of Tropical Medicine, Mahidol University	102	Artem(50) Vs. Quin(52)	Faster Parasite clearance, mortality	*Trans R Soc Trop Med Hyg. 1995 Nov-Dec;89(6):668-71.*

CURRENT RECOMMENDATION

- Artimisinin derivatives like artisunate , artimether are drug of choice for severe malaria.
- Artisunate has the advantage of being water soluble and can be given I.V.

CURRENT RECOMMENDATION FOR EXCHANGE BLOOD TRANSFUSION

- Currently there are no randomized control trials to show any benefits of exchange blood transfusion over conventional therapy.
- Procedure is hazardous and availability of blood is a limiting factor.
- Currently WHO does not recommend exchange blood transfusion in the management of severe malaria.

OTHER ADJUVANT THERAPY

- Corticosteroids
  - No survival benefit
  - GI bleed
- Anticonvulsants
  - Phenobarb
- Others
  - Adrenaline
  - Heparin
  - Prostacyclin
  - Pentoxyfylline - No established role
  - Cyclosporin A
  - Iron chelators
  - Anti TNF

ROLE OF aPC IN MALARIA/LEPTOSPIROSIS

Report	Clinical scenario	Inference	Reference
Drotrecogin alfa (activated) in severe falciparum malaria	**severe falciparum malaria parasitaemia levels of 40% MODS**	**aPC for 96 hrs f/b gradual improvement**	***Anaesthesia, 2006, 61, pages 899–902***
Case series of 10 patients with tropical infections	**Includes 4 cases of falciparum and I leptospirosis**	**1 out 4 died**	***Intensive care Med (2006) 32:1281–1282***

LEPTOSPIROSIS

INTRODUCTION

- Zoonotic disease.
- Transmitted by contact with infected urine and rarely blood of infected rodent.
- Penetration recurs through intact mucous membrane or abraded skin.

PATHOGENESIS

- Septicemic phase – vascular injury
- Immune phase – immune complex deposition

PATHOGENESIS OF LUNG INJURY

- In contrast to liver and kidney, isolation of leptospires is uncommon from lung tissue.
- Antigenic debris is also less common in lungs.
- Widespread but subtle inflammatory process.
- Presence of antibody along the septal wall in infected guinea pigs may suggest an autoimmune response similar to Goodpastures disease (Abs to type IV collagen).But renal tissue did not reveal glomerulonephritis characteristic of Goodpasture disease.
- The exact mechanism is largely unknown.

CLASSICAL FEATURES OF LEPTOSPIROSIS

- Biphasic illness -1)Septicemic phase
  2)Brief afebrile period
  3)Immune phase
  (liver and kidney)
- Diagnosis in early phase is commonly missed.
- Hence Faine proposed a clinical scoring system which has good sensitivity (81.8%) and specicity(72.9%).
- Usually helpful in excluding diagnosis because of high negative predictive value.

J Postgraduate Med.2005 Sept.51(3),169

Faine's Criteria[8] Part A: Clinical data	Score	Modified Faine's Criteria[25] Part A: Clinical data	Score
Headache	2	Headache	2
Fever	2	Fever	2
If fever, temperature 39°C or more	2	If fever, temperature 39°C or more	2
Conjunctival suffusion (bilateral)	4	Conjunctival suffusion (bilateral)	4
Meningism	4	Meningism	4
Muscle pain (especially calf muscle)	4	Muscle pain (especially calf muscle)	4
Conjuctival suffusion + Meningism + Muscle pain	10	Conjuctival suffusion + Meningism + Muscle pain	10
Jaundice	1	Jaundice	1
Albuminuria or Nitrogen retention	2	Albuminuria or Nitrogen retention	2
Part B: Epidemilogical factors		Part B: Epidemilogical factors	
Contact with animals or contact with known contaminated water	10	Rainfall	5
		Contact with contaminated environment	4
		Animal contact	1
		Total	10
Part C: Bacteriological and Lab. findings		Part C: Bacteriological and Lab. findings	
Isolation of leptospire in culture – diagnosis certain		Isolation of leptospire in culture – diagnosis certain	
Positive serology (MAT)		Positive serology	
Leptosirosis endemic			
Single positive low titre	2	ELISA IgM positive*	15
Single positive high titre	10	SAT positive*	15
Leptosirosis non-endemic			
Single positive low titre	5	MAT single high titre*	15
Single positive high titre	15	MAT rising titre (paired sera)	25
Rising titre (paired sera)	25		
Total Score		Total Score	

LUNG INVOLVEMENT

- Ist publication of lung involvement in leptospirosis is attributable to Moeschlin in 1943.
- Varies between 20%-70% in all cases in various studies.
- Pulmonary examination ranges from normal to extensive alveolar hemorrhage and respiratory failure.
- Patients with severe alveolar hemorrhage can die within 24 hrs.
- BAL examination in patients with leptospirosis by D u couedic and colleagues found that alveolar hemmorrhage was present in all patients with sign /symptom of respiratory involvement and 7/10 patients in asymptomatic patients.

Med Trop.1992,25:21-30

LUNG INVOLVEMENT (CONTD)

- There is absence of significant inflammation in areas of hemorrhage.
- Usually associated with hepato-renal involvement but can occur in the absence of these.

J.Infect.Disease.1998;178;1457-63

LAB DIAGNOSIS OF LEPTOSPIROSIS

TEST	ADVANTAGE	DISADVANTAGE
A)MICROSCOPY		
DGM	Convenient	Lacks sensitivity and specificity.
Immunofluoroscent staining	Can be done on blood, urine or rarely CSF.	10,000 leptospira/ml for visualization is necessary.
Immunoperoxidase staining	Can be done on blood, urine or rarely CSF.	10,000 leptospira/ml for visualization is necessary.

LAB DIAGNOSIS OF LEPTOSPIROSIS

TEST	ADVANTAGE	DISADVANTAGE
B) SEROLOGY		
MAT	Gold standard Highly sensitive Detects group specific Abs.	Complex Requires maintaining strains for preparation of Ag.
IgM ELISA	Most widely used (sensitivity 100% and specificity 93%)	
IgG ELISA		High rate of false positive.
Indirect Fluorescent Antibody test	Rapidity	
Microscopic slide agglutination	High sensitivity and specificity	
CIEP		

LAB DIAGNOSIS OF LEPTOSPIROSIS

TEST	ADVANTAGE	DISADVANTAGE
C) Culture	Gives confirmed diagnosis	Low sensitivity Cumbersome Requires atleast 1 month before can be declared negative
D) Molecular diagnosis 1)Dot blotting 2)In situ hybridization 3)PCR	Useful for DNA detection in serum and urine. Useful when other tests fail to establish diagnosis. Used for post mortem diagnosis.	Inability to identify serovar. Cost and availability.

PROGNOSTIC MARKERS

- **Multivariate analysis revealed three variables associated with mortality**

VARIABLE	ODDS RATIO	P VALUE
Hemodynamic disturbance	6 (CI 0.9-38.5)	0.005
Serum creatinine>265.2umol/l	10.6 (0.9-123.9)	0.02
Serum potassium>4	19.9 (1.2-342)	0.009

Clin Infect. Disease.1999,29;1561-3

TREATMENT OF LEPTOSPIROSIS

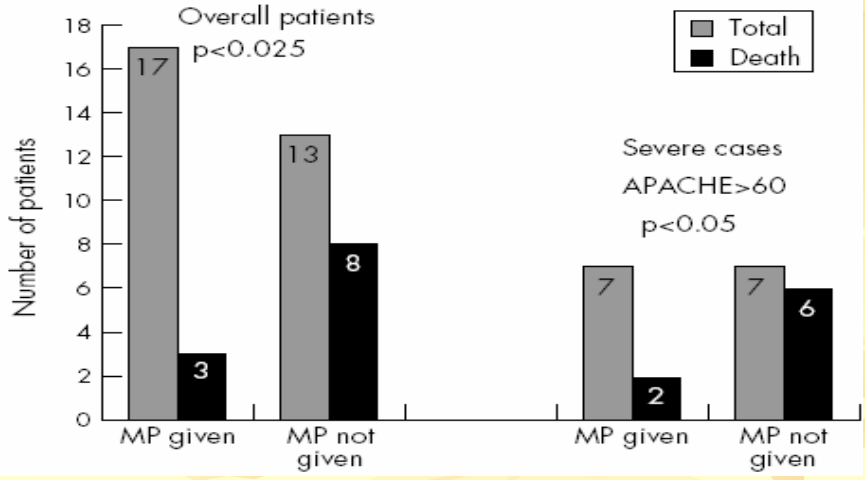
- Ceftriaxone was found effective in severe leptospirosis in a study by Raptis et al .
- 23 patients were given ceftriaxone out of which 21 survived.No significant ADR noted.

Int J Antimicrobial Agent 2006 Sept,28(3);259-61

TREATMENT OF LEPTOSPIROSIS

- A prospective,open label, randomized trial in Thialand was conducted in 2000-2001,where they compared ceftriaxone(1 gm/day for 7 days) with sodium penicillin G (1.5 MU 6 hrly for 7 days).
- Both were found equally effective with median duration of fever was 3 days and equal number of deaths (5) were found in each group.

ROLE OF STEROIDS IN LEPTOSPIROSIS



Shenoy et al , Postgrad. Med. J. 2006;82;602-6

AMOEBIASIS

INTRODUCTION

- Protozoan infection caused by Entamoeba histolytica.
- Third most common cause of death from parasitic diseases after malaria and schistosomiasis worldwide.
- Extraintestinal manifestations are the most comon cause of death.

EXTRAINTESTINAL SITES INVOLVED

1) Amoebic liver abscess-most common.
2) Pleuro-pulmonary – second most common.
3) Pericardial.
4) Brain.
5) Genitourinary tract.

RISK FACTORS FOR AMOEBIASIS

1) Lower socio-economic class
2) Poor hygiene
3) Lack of safe drinking water
4) Male homosexuals
5) Travellers
6) Prisoners

RISK FACTORS FOR PULMONARY AMOEBIASIS

1) Malnutrition
2) Alcoholism
3) ASD with left to right shunt

MODES OF PULMONARY INVOLVEMENT

- Primary - Very rare
  - Inhalation of dust containing cysts.
  - Aspiration of cysts or triphozoites of amoeba.
- Secondary- Infrequent.
  - Hematogenous spread from colon.
- Tertiary - Most common. Extension of amoebic liver abscess

ROUTES OF INVOLVEMENT

Routes of involvement	Percent
1) Abcess extending from liver	37.2
2) Bronchohepatic	19.6
3) Empyema extending from liver	17.6
4) Hematogenous spread without liver involvement	14.3
5) Hematogenous lung abcess and independent liver abcess	10.4

TYPES OF LUNG INVOLVEMENT

Types of lung involvement	Percent
1) Heptobronchial fistula	47
2) Pleural effusion and empyema	19
3) Lung abscess	14
4) Consolidation	10

CLINICAL FEATURES

- Fever of weeks duration and right upper abdominal and right pleuritic type of chest pain.
- Dramatic presentation of severe pain,respiratory distress and shock.
- Hepatomegaly in 50% cases.
- Hemoptysis is common followed by expectoration of ancchovy sauce like pus.
- Bile in sputum is important clue toward hepatic origin.

DIAGNOSIS

- When to suspect amoebiasis-

1)Elevated hemidiaphragm.

2)Hepatomegaly.

3)Pleural effusion.

4)Basal pulmonary involvement in patient from endemic area >3 years age.

DIAGNOSIS

- Lateral radiograph: -

1) Upward hump like prominance which can be anterior, middle or posterior.Anterior hump is more common.
2) Consolidation which may have cavitation.
3) Pleural effusion.
4) Hydropneumothorax-bronchopleural fistula.
5) Cavity with air fluid level in case of bronchial communication.

DIAGNOSIS

Stool examionation :-

- Limited value.
- Only positive in 15-33% cases of extraintestinal amoebiasis.
- Pathogenic and nonpathogenic amoeba can be differentiated by zymodeme analysis,ELISA,RFLP.

Sputum examination :-

- Usually sterile and paucicellular unless superinfected.

ROLE OF ULTRASONOGRAPHY

- Monitoring response to therapy.
- To detect small pleural effusion.
- To look for subpulmonic collection.
- To differentiate from bacterial empyemas – loculations and septations are rare in amoebic empyemas.

WHAT IS ROLE OF CT SCAN?

- Can detect intrapleural fluid anywhere in the thorax example beneath scapula or within fissure which is usually missed by USG.
- Guide interventional procedure.
- To differentiate empyema with bronchopleural fistula from lung abscess.

IMMUNOLOGICAL TESTS IN AMOEBIASIS

A)Conventional-

1)IHA
2)ELISA — for IgG and IgM , IgM is more specific
3) IFAT

B)Newer-

1) Gal or GalNAC inhibitable adherence lectin IgM - Potential role in extraintestinal amoebiasis.
2) Gal-GalNAC Ag by ELISA- >90% sensitivity before treatment.
3) E.histolytica Ag detection kit- useful for sputum and pleural fluid.
4) DNA by PCR- most sensitive method of detection of pleuropulmonary amoebiasis.

DIFFERENTIAL DIAGNOSIS OF AMOEBIASIS

- Lung carcinoma
- Pulmonary tuberculosis
- Lung abscess
- Sarcoidosis
- Hydatidosis

- Presence of palpable liver can be mistaken as secondary.
- Anterior basal segment of right lower lobe involvement is characteristic of amoebic origin.

TREATMENT OF AMOEBIASIS

- Oral or parentral metronidazole 800 mg (35-50 mg/kg/day) three times daily for 5-10 days is the treatment of choice.
- Chloroquin and emetine are other alternatives but should be avoided because of potential cardiovascular side effects.

PULMONARY HYDATID

INTRODUCTION

- Hydatidosis is one of the most geographically widespread zoonoses in the world.
- Four species of Echinococcus are recognised.

EPIDEMIOLOGY OF HYDATID DISEASE

Species	Geographical distribution	Definitive Host	Intermediate Host	Transmission
E.granulosus	Mediterrean region,eastern Europe,Africa,South america middle east,China,Australia, New Zealand	Dogs	Sheeps	Feco-oral route
E.multilocularis	Arctic,Asia,Western central europe	Foxes, Wolves	Rodents	Ingestion
E.Vogeli	South America	---	---	
E.oligarthia	South America	---	---	

LUNG INVOVLEMENT IN HYDATID

- Through transdiaphragmatic thoracic involvement- most common.
- Hematogenous dissemination.
- Lymphatic dissemination.

LUNG INVOLVEMENT IN HYDATID

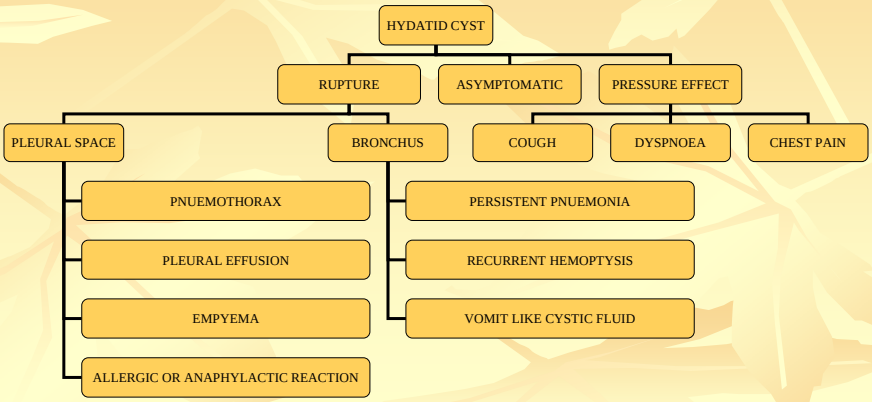
- Sometimes lesions develop in area of lung remote from diaphragm-

1)Hematogenous spread.

2)Transbronchial spread.

3)Rupture of liver abscess into inferior vena cava and thromboembolic disease which may progress to pulmonary hypertension and cor pulmonale.

PLEURO-PULMONARY MANIFESTATIONS OF HYDATID



DIAGNOSIS OF HYDATID DISEASE

1) Specific serum antibodies.
2) Chest X-ray –

- Solitary lesions- 60% cases.
- Multiple –unilateral/bilateral lesions in 25-50%.
- Ruptured cyst-Consolidation surrounding area.
  It communicates with bronchus-air fluid level.
- Miniscus sign or crescent sign.
- Cumbo's sign (onion peel sign).
- Water lily sign.
- Mass within a cavity.

Newer signs

- Rim sign.
- Inverse crescent sign.

TREATMENT OF PULMONARY HYDATID

- Surgery is the mainstay of the therapy – as complete elimination of parasite can only lead to cure.
- The principle is to preserve as much lung tissue as possible.
- Akin et al observed that radical resection is too aggressive and often not necessary.
- Paraenchyma around a hydatid cyst is often affected by lesion and may show chronic congestion,hemorrhage,bronchopneumonia or interstitial pneumonia.
- These changes often resolve after surgery, hence parenchymal resection is rarely indicated.

TREATMENT OF PULMONARY HYDATID (CONTD)

Conservative surgery are preferred.

1)Enucleation.

2)Pericystectomy.

3)Simple cystectomy.

4)Cystectomy with cappitonage.

- Spillage of daughter cyst is to be avoided.
- Recurrence can occur but fresh infection is also reported in person living in endemic area.

Bilateral pulmonary hydatid :-

- One stage/two stage surgery.
- Larger cyst/ruptured cyst area treated first.

RECENT ADVANCES N THE TREATMENT OF PULMONARY HYDATID

- Thoracophrenotomy is less invasive & preferred method of surgery in cases of combined lung & liver hydatid

Br.J.surg.2005;92(6);729-33

- Recent reports have described VATS in pulmonary hydatid.

CAN J SURG.2004;47,380-381

TREATMENT OF PULMONARY HYDATID (CONTD)

- **Medical therapy**:-
- Advocated by few authors.
- Mebendazole/Albendazole.
- 68-70% of patients with pulmonary hydatid show some degree of response.
- 25-34% cure rates have been documented.
- Considering high risk of complications, hydatidosis patients should be followed closely.

PARASITOL.INT.2005;54;135-138

DRAWBACKS OF MEDICAL THERAPY

- Poor compliance and ADR due to long course of treatment.
- Poor follow up – most patients are from rural areas.
- Poor cure rates.
- High risk of complications.

CONSENSUS

- Lung hydatids produce more complications than liver,hence all patients of pulmonary hydatid irrespective of size or presence/absence of complications are to be surgically treated.
- Medical therapy should be used to prevent recurrence.
- Recommended regimen – mebendazole 1 month preoperative & 3 interrupted courses postoperatively

TROPICAL PULMONARY EOSINOPHILIA (FILARIASIS IN LUNG)

INTRODUCTION

- One of the many syndromes with pulmonary infiltrates and peripheral blood eosinophilia.
- Originally described in India in 1940.
- ILD thought to be due to immunological hyperresponsiveness to human lymphatic dwelling filarial parasites-W.bancrofti and B.malayi.

DIAGNOSTIC CRITERIA FOR TPE

- Cough worse at night.
- count >3300/cube mm.
- Clinical Residence in filarial endemic areas.
- Eosinophil and hematological response to DEC.

Filarial antibody test has little value.

RESP. MED. 1999;93;655-659

PATHOGENESIS

- Out of 90 million people infected worldwide,<1% manifest symptoms of TPE.
- Exact reason is not known.
- Intense inflammation of lung parenchyma to trapped microfilaria which are released into circulation by adult worms residing in lymphatic system.
- Microfilaria are always absent in peripheral blood smear.
- Sometimes detected in lung biopsy specimens.

PATHOGENESIS (CONTD…)

- BAL of affected individuals reveal that polyclonal IgE and filarial specific IgM,IgG and IgE accumulate in the lung.
- Eosinophilic alveolitis.
- Profound dysregulation in otherwise tightly regulated IgE Ab response.
- Limited evidence to suggest underlying genetic basis.
- Usually complete resolution after therapy with DEC but in some cases some degree of irreversible interstitial fibrosis occurs.
- Pathogenesis in some aspects analogues to atopic asthma
  - obstructive ventilatory picture.
  - partial reversibility with beta2 agonists.
  - high levels of serum IgE.