(88 - Mycobacteria

I) Mycobacterium tuberculosis.

III) Mycobacterium leprae.

II) NTM. (Non TB Mycob.) (or) Atypical Mycobacteria

I) MTB - Mycobact. Tuberculosis :

Virulence Factors (2).

① LAM
Lipo Arabino - Mannon

② Mycolic a
(acid fastness of Mycob.)

"ANTIPHAGOCYTIC"
Prop. of all pathogenic mycob. is due to these ②.

Clinical manifestn: TB.

pulmonary TB. → lungs.

Extra pulmonary TB. → other organs.

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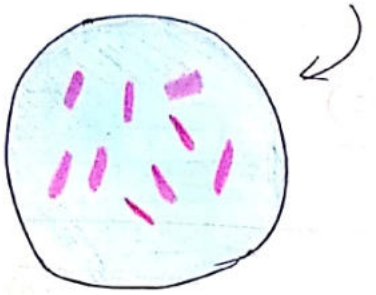
i) Microscopy
- a) Z/N stain (Ziehl Acid fast)
- b) Direct Immuno fluorescence Test

a) Z/N - Stain:

Appearance: blue background
↓
Small pink rods.



Advantages:
- * cheap & easily available
- * m/c.
- * No expert reqd.

Disadv:
- * Not the best
- * Not Recommended.

b) Direct - Immunofluroscence staining (Best) & Recommended.

detect Ag.
↓
with A.b. → attached to dye.
↓
Ab - Ag binding represented by fluoroscence.

Disadv:
- * Req. Experts.
- * Costly.
- * Difficult to perform

~~Culture~~ Solid culture is NOT used for MTB

bcoz it takes 1½ - 2 months to grow MTB

So liquid culture is preffered

a) Liquid culture:

* MGIT method is used.
(Mycobact. Growth Indicator Tube).

⇓

Not a manual method but an Automated method, Technique used is "BACTEC" method.

Advantages:

* Early detecn ⇒ 3-4 weeks growth ✓

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b) Solid Culture:

Disadv: 6-8 weeks. → for Growth :(

- LJ (egg based)
  - LJ - Loweinstein Jenson.
  - ⇓
  - m/c used.
- Middle ~~group~~ brook. media
  - (Agar based)
    - 7H10
    - 7H11
    - best ✓

Molecular Methods: PCR based

- a) CBNAAT
  CB – Cartridge Based
  NAAT - Nucleic acid Amplifn Test
  (m/c used)
- b) Line Probe Assay (LPA)

a) CBNAAT : aka "Gene Xpert"

Advantages:

* Not only ID. but also.
  AST of rifampicin can be done.
  (core drug - TB).

* Turn Around Time ~ 2 hrs. only so early diagnosis & Rx of pt. is made

(Note: MDR - Multi Drug Resistant TB)
(Rifampicine).

b) Line Probe Assay (LPA).

Advantage:

(i) Not only ID but also AST
(ii) AST of all drugs of TB.
⇓
So Doctor can conclude which drug can be used

Disadvantage:

(i) Takes 2 days ☹

ELISA based:
Quantiferon TB gold assay.

aka: IGRA.

Interferon Gamma (INF γ). Release Assay

* "Quantiferon."
⇓
In this test, we are going to Quantify INF γ.

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* TB pt ⇒ INF γ released & measured.

Not TB. ⇒ INF γ not released.

Steps:

Step ①: Take blood sample.

Step ②: Add MTB Ag.

Step ③: T-cells of pt. if sensitized to TB will release INF γ (when they encounter MTB - Ag.

Step ④: INF γ - measured.

Rapid Test.
(< 30 mins).

* V. rapid.

* Detect MTP 64 Ag.
⇓
present only in MTB.

* MTP 64 Ag can also be used to differentiate b/n. MTB & Atypical mycobacteria

v) Skin Test / Tuberculin Test / Mantoux Test :

* Type IV Hyper Sensitivity Rxn

* Inject 0.1 mL PPD. (purified protein Derivative) I/D. (Intradermally). on flexor asp. of forearm.

Then Reading is taken after 48hrs. & Cin. 72 hrs. (Not <48h & Not >72h.)

Measure INDURATION. (not erythema).

- < 10 mm → ⊖ve.
- > 10 mm → ⊕ve Mantoux's Test.

Topic: Mycobacteria / NTM:

Classified by Runyon:

- ① Slow Growers. (> 7days for growth in solid culture).
  - a) photo chromogens
  - b) scoto chromogens
  - c) Non chromogens.
- ② Rapid Growers (grows within 7days)

eg:
- M. fortuitum.
- M. chelonae & abscessus.
- M. smegmatis.

① Slow Growers:

a) photo chromogens:

* produces pigments in the presence of light.

eg:
- M. kansasii
- M. marinum
- M. simiae.

b) Scoto chromogens: * produces pigments in dark.

eg:
- M. scrofulaceum
- M. gordonae
- M. szulgai.

c) Non-chromogens: dont produce pigments in both light & dark

eg:
* M. avium (i) intracellulare (ii) complex (MAC). → (i)+(ii)
* M. ulcerans → only mycobacteria which produces Toxin Mycolactone.
* M. xenopi

CLINICAL MANIFESTATns.

- i) Cutaneous ds.
- ii) Lymph Node ds.
- (iii) Respiratory ds.

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i) Cutaneous ds:

- M. marinum (photo).
  - aberratn during in skin cleaning of
    - → Fish Tank granuloma
    - → Swimming pool granuloma
- M. ulcerans (Non chrom.) → Buruli ulcer.
  - (mycolactone Toxin) → (only mycob. to produce Toxin.)

(ii) Lymph Node Ds:

- M. scrofulaceum (scoto) →
  - scrofula – glandulas swelling
  - ⇓
  - Lymphadenguitis / LN pathy

(iii) Respiratory ds.

- Most of Atypical mycobacterium Causes Resp. manifestn

eg: m/imp is

- MAC → Pneumonia.
  - (M. avium intracellulare complex)
  - (Non chrom.)
  - aka Battey Bacillus

MTB ---- except only one Ag. → MPT64 Ag (Rapid Test).

- present in MTB
- absent in atypical mycobacterium

III) M. leprae: causes Leprosy

Leprosy classified by Ridley Jopling's into (5).

- Tuberculoid Leprosy:
  - ① TT – Tuberculoid Leprosy
  - ② BT – Borderline Tuberculoid "
  - ③ BB – Borderline Leprosy
- Lepromatous Leprosy:
  - ④ BL – Borderline lepromatous leprosy
  - ⑤ LL – Lepromatous leprosy.

mild → Severe

Clinical manifestatn:

(i) Tuberculoid Leprosy: (TT, BT, BB).

- milder form
- pauci bacillary ⇒ Bacterial load is less.
- so lesions are also few. (skin & N/V).
- CMI - good (cell med. immn.) ⇒ so Lepromin Test will be ⊕ve

Lepromatous Leprosy (BL, LL).

- Severe.
- Multi bacillary.
- Multiple lesions on skin & N/v.
- CMI inadequate

↓

even though BL,LL is severe due to inadeq. CMI

↓

Lepromin Test will be θve

LEPRA REACTIONS

i) Type ①
ii) Type ②.

⇓

Hypersensitivity Rxns during Course of Leprosy ds.

i) Type ①:

* Its a Type IV Hypersensitivity
* Body reacts with TH_1 immune response predominantly.
* Type ① usually occurs at BB stage (3).

Now,

TT stage (mild) ← pt. improves to ... Reversal reaction. — BB stage — pt. collapses to ... → LL Stage Severe.

down grading Reaction

Rx → Glucocorticoids.

* ~~Type~~ Hypersensitivity

* Body reacts with TH_2 Imm. resp. predomin.

* Usually occurs at LL stage (5) most severe.

(X) LL Stage → pt. collapses to... → Leprosy infects other organs. Testes, kidney & eyes.

→ papules convert to → Nodules

Erythema Nodosum Leprosum (ENL).

R_x → Glucocorticoids (+).
Clofazimine (or)
Thalidomidine

Dx:

(i) Microscopy:

a) Z/N Stain → blue background.

Globi (Cigar shaped bundle).

(X) Characteristic feature of M. leprae.

MTB, Atypical M. → Small pink rods

M. leprae → also " " but Cigar shaped bundle arrangement

b) Direct ~~I.F~~.

ii) CULTURE (Specific) NON - cultivable.

* Animal innoculatn method. (Viral Cultivation method)

Animals used: i) (9) banded Armadillo.

(or)

ii) Foot pad of mice.

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iii) Immunological :

- ELISA
- FLA - ABS
  - (F)luorescent (L)eprosy
  - (A)ntibody (A)bsorpn Test

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iv) Skin Test / Lepromin Test

* Type IV Hypersensitivity

* 0.1 mL of PPD. → i/d. in flexor asp. of forearm

(2) Readings Taken

- 1st @ 48 hrs
  - Early Fernandez Rxn
  - Erythema > 10mm
  - ⊕ ve
- 2nd @ 21 days
  - LATE Mitsuda Rxn
  - Nodule > 5mm
  - ⊕ ve