INFECTIONS, CANCER AND IMMUNOTHERAPY

By Aleena B
Distribution of cancers caused by infections globally.

15% of global cancers are caused by infections.
CANCERS WITH MAJOR INFECTIONS DRIVERS

• Cervical cancer – human papilloma virus (HPV).
• Liver cancer - Hepatitis B and C.
• Some lymphomas caused by viruses.
• Some stomach and duodenal cancer caused by the bacteria H. pylori.
• Rarer cancers caused by specific parasitic infections.
• HIV increases risk of lymphoma Kaposi’s sarcoma.
CERVICAL CANCER

- 500,000 women affected globally.
- 3000 cases in the UK.
- 850 deaths in the UK.
- Preventable
- Almost all cervical cancers are caused by Human Papillomavirus.
- Over 40 genital HPV viruses.
- HPV16 and HPV18 responsible for 50-70% of Cervical cancers.
Human Papillomavirus

- Many types of HPV affect the mouth, throat and genital areas.
- High risk HPV can cause cancers of the:
  - Cervix,
  - Anus,
  - Penis
  - Vagina
  - Neck
  - Mouth.
- Low risk HPV can cause:
  - Genital warts
  - Abnormal changes in cells that can cause cancer.
SMEAR TEST

• Not a test for cancer but to prevent cancer.
• Available to all women between 25-64
• Small sample of cells collected and tested for high risk types of HPV that can cause changes to the cells of your cervix.
• Screening introduced in 1988.
• 30-40 % decrease in cervical cancer rates.
• Approx. 5000 women saved each year.
HPV VACCINE

- Since 2008 Cervarix vaccine given which protects against HPV16 and HPV18 - 82% efficacy.
- Switched to Gardasil in 2012
- Vaccine protects against high risk types of HPV and even strains that can cause genital warts.
- 2 doses
Vaccinating Boys

• Since September 2019 boys in the UK have been vaccinated against HPV.

• Many reasons:
  • Herd immunity
  • Men get cancers caused by HPV too
  • More cases of head and neck cancer in the US compared to cervical.
  • Currently not test for HPV in males.
  • The odds of getting HPV related cancer increases with age.
  • Vaccine is just as safe for girls as it is for boys.
H. Pylori increases risk of gastric cancer.

- H. Pylori infection causes chronic inflammation and increases risk of developing duodenal and gastric ulcer disease and gastric cancer.
- Gastric cancer is the 2\textsuperscript{nd} highest cancer that causes deaths globally.
- Most commonly associated with peptic ulcer disease.
Treatment for *H. Pylori*

- Antibiotic prescription
- Proton Pump Inhibitors (PPI’s)
- Reduce Non-steroidal anti-inflammatory drug (NSAID) intake.
HIV

- Increases risk of several types of cancer:
  - Kaposi’s sarcoma (HHV-8)
  - Non-Hodgkin and Hodgkin lymphoma (EBV)
  - Cervical and other HPV cancers
  - Liver cancer (Hepatitis B and C)
Kaposi’s Sarcoma

• Caused by Human Herpesvirus (HHV-8).
• People with HIV are 500 times more likely to develop Kaposi’s sarcoma than those not infected.
• A disease where cancer cells are found in the skin or mucous membranes that line the GI tract.
• Symptoms include lesions in the skin, internal lesions and painful swelling in legs.
• Can be treated by antiretroviral drugs.
IMMUNOTHERAPIES

- Monoclonal antibodies
- Checkpoint inhibitors
- Vaccines
- Cytokines
- CAR-T cell therapy
CAR T cell therapy
How does cancer evade the immune system?

• Abnormal proteins encoded by mutated genes in pre-cancerous cells can be detected by our immune system.
• Small fragments of proteins from inside cells are displayed on their surfaces by a collection of proteins called the Major Histocompatibility complex (MHC)- enables Tc cells to see cancer.
• Some mutations in pre-cancerous cells allows them to avoid Tc cell attack- by preventing the display of abnormal protein fragments on the MHC.
• CARs are designed to enable the T cells to see the cancer cells.
Emily Whitehead

- In 2010, 5 year old Emily was diagnosed with acute lymphoblastic leukaemia.
- Experimental CAR T cell therapy offered by Children’s hospital of Pennsylvania.
Figure 2  How CAR T cells are manufactured and used to treat patients.
Conclusion:

• There are a lot of cancers that can be prevented by stopping the spread of infections.

• Disparity in global vaccinations/healthcare.

• New upcoming immunotherapies have proven successful.

• We still have a long way to go in cancer treatment.