Pathological Effects of Tobacco

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Scenario

• Tobacco, or the Big ‘T’ is one of the most widespread global epidemic.

• Current burden – 1.3 billion users (WHO 2015). Expected to decrease up to 1.1 billion users by 2025.

• Fortunately, with Tobacco control measures, the number is slowly coming down.

• India alone has 275 million users (163 million smokeless users, 69 million smokers and 42 million ‘both’ users).
Consumption

Global Cigarette Consumption by WHO Region, 1980–2013, in trillions
Past and future
Annual deaths due to tobacco estimated worldwide
1950–2030 projected

industrialised countries

developing countries

will eventually be killed by tobacco
Harm from Tobacco

Smoking Form
- Harm due to Smoking
- Second-Hand Smoke
- Third-Hand smoke

Smokeless Form
- Harm to Individual
- Harm to the Environment eg: Spitting, Tobacco litter
Mechanism of Action - Adverse Health Effects

Figure 4-1. Conceptual model of carcinogenesis of smokeless tobacco use

1. Initiation of tobacco use/nicotine addiction
2. Tobacco use
3. Carcinogens
   - Metabolic activation
   - DNA adducts
   - Persistence miscoding
   - Repair
   - Normal DNA
   - Apoptosis
4. Mutation in RA5, P53, and other genes
5. Cancer

Abbreviations: DNA = deoxyribonucleic acid; Hb = hemoglobin
Sources: Boffetta et al. 2008 (18); Hecht 1999 (19). Reproduced with permission.
Physiological Effects of Tobacco

- Blood
  - Increased clotting tendency

- Lungs
  - Bronchospasm

- Muscular
  - Tremor
  - Pain

- Gastrointestinal
  - Nausea
  - Dry mouth
  - Dyspepsia
  - Diarrhea
  - Heartburn

- Joints
  - Pain

- Central
  - Lightheadedness
  - Headache
  - Sleep disturbances
  - Abnormal dreams
  - Irritability
  - Dizziness

- Heart
  - Increased or decreased heart rate
  - Increased blood pressure
  - Tachycardia
  - More (or less) arrhythmias
  - Coronary artery constriction

- Endocrine
  - Hyperinsulinemia
  - Insulin resistance
Pathologic Effects of Tobacco

**Eyes**
- Blindness (macular degeneration)
- Cataracts
- Stinging, excessive tearing and blinking

**Ears**
- Hearing loss
- Ear infection

**Nose**
- Cancer of nasal cavities and paranasal sinuses
- Impaired sense of smell

**Heart**
- Coronary thrombosis (heart attack)
- Atherosclerosis; damage and occlusion of coronary vasculature

**Chest & Abdomen**
- Possible increased risk of breast cancer
- Oesophageal cancer
- Gastric, colon, and pancreatic cancer
- Abdominal aortic aneurysm, peptic ulcer (stomach, duodenum, and oesophagus)

**Hands**
- Peripheral vascular disease; poor circulation (cold fingers)

**Male Reproduction**
- Infertility
- Sperm deformity; loss of motility; reduced number
- Impotence

**Skeletal System**
- Osteoporosis
- Hip fracture
- Susceptibility to back problems
- Bone-marrow cancer

**Circulatory System**
- Buerger’s disease (inflammation of arteries, veins, and nerves in the legs)
- Acute myeloid leukemia

**Brain & Psyche**
- Stroke (cerebrovascular accident)
- Addiction/withdrawal
- Altered brain chemistry
- Anxiety about tobacco’s health effects

**Mouth & Throat**
- Cancers of lips, mouth, throat, larynx, and pharynx
- Sore throat
- Impaired sense of taste
- Halitosis (bad breath)

**Hair**
- Odour and discoloration

**Teeth**
- Periodontal (gum) disease; gingivitis; periodontitis
- Loose teeth, tooth loss
- Root-surface caries, plaque
- Discoloration and staining

**Lungs**
- Lung, bronchus, and tracheal cancer
- Chronic obstructive pulmonary disease (COPD); emphysema
- Chronic bronchitis
- Respiratory infection; influenza; pneumonia; tuberculosis
- Shortness of breath; asthma
- Chronic cough; excessive sputum production

**Skin**
- Psoriasis
- Loss of skin tone; wrinkling; premature ageing

**Liver**
- Liver cancer

**Kidneys & Bladder**
- Kidney and bladder cancer

**Female Reproduction**
- Cervical cancer
- Premature ovarian failure; early menopause
- Reduced fertility
- Painful menstruation

**Wounds & Surgery**
- Impaired wound healing
- Poor postsurgical recovery
- Burns from cigarettes and from fires caused by cigarettes

**Immune System**
- Impaired resistance to infection

**Legs & Feet**
- Peripheral vascular disease; cold feet; leg pain; gangrene
- Deep vein thrombosis

1. Tobacco Related Cancer

• Global Burden:
  • 14 million new cases
  • 8.2 million deaths

• India
  • 2.5 million cancer cases (35-64 yrs age group)
  • Tobacco contributes to 40% of cancer deaths.

• Tobacco-related cancers:
  • Commonest is Lung Cancer
  • Followed by Oral and Esophageal cancer
India - 1 in 17 males and 1 in 50 females have a lifetime risk of tobacco related cancers.
Lung Cancer

• Peak incidence occur between ages 55-65 years.

• 3:1 is the male : female ratio
• Physical signs:
  • Excessive Cough
  • Chest Pain
  • Wheeze
  • Tenderness at base
  • Hoarseness of voice

• Extra-pulmonary manifestation:
  • Endocrine:
  • Neurological:
  • Others:
Oral Cancer

• Besides Tobacco, other risk factors are:
  • Alcohol
  • Malnutrition
  • Human Papilloma Virus (HPV-16)
  • Sunlight

• Warning Signs:
  • A sore which does not heal
  • Changes in tissue color (Red or White patch)
  • Trouble opening
  • Chronic Lump in throat
  • Ear pain
The Word of Mouth on ORAL CANCER

DIAGNOSIS & SURVIVAL

450,000 new cases of oral cancer each year worldwide

In the US, more than 43,000 people were diagnosed with oral cancer in 2014

In the U.S. a person dies from oral cancer every hour of every day

More than 40% of those diagnosed with oral cancer die within five years

EARLY DIAGNOSIS CAN DOUBLE A PATIENT’S CHANCES OF SURVIVAL TO 40% DOUBLED TO 80%–90%

RISK FACTORS FOR ORAL CANCER

WHAT RAISES YOUR RISK FOR ORAL CANCER?

Tobacco use: No amount is safe; risk increases with use

Alcohol use: 7+ drinks per week, 14+ drinks per week

Exposure to the HPV-16 virus

The risk is 15X greater for people who both smoke & drink
Oral - Potentially Malignant Disorders

Potentially Malignant Lesions: Morphologically altered tissue in which cancer is more likely to occur.

Leukoplakia

Erythroplakia

Palatal Changes with Reverse Smoking
Potentially Malignant Conditions: Generalized state associated with a significantly increased risk of cancer.

Lichen Planus

OSMF (see the reduced mouth opening)
Other cancers

- Esophageal Cancer:
- Pancreatic Cancer:
- Cervical Cancer:
- Liver cancer:
- Cancer of Colon and Rectum:
- Acute Myeloid Leukemia:
2. Cardiovascular Effects

- Nicotine
  - Sympathetic Nervous System Activation
    - Increases
      - Heart Rate
      - BP
      - Myocardial Contractility
    - Other effects
      - Coronary Vasoconstriction
      - Myocyte Hypertrophy
    - Increases
      - Myocardial Oxygen Consumption
  - Increases
    - Myocardial Ischemia
    - Myocardial Infarction

- Polycyclic Aromatic Hydrocarbons & Heavy Metals
  - Inflammation
    - Endothelial Dysfunction & Atherosclerosis
    - Thrombosis
  - Reduces
    - Myocardial Blood, Oxygen and Nutrient Supply

- Other effects
  - Reduces
    - Myocardial Ischemia
    - Myocardial Infarction
HYPERTENSION WORLDWIDE

Worldwide, 1 in 3 adults has high blood pressure—a condition that leads to heart attack and stroke.

Everyone can take five concrete steps to help prevent high blood pressure:

- Healthy diet
- Physical activity
- Avoiding tobacco
- Avoiding harmful use of alcohol
- Managing stress in healthy ways
3. Diabetes and Insulin Resistance

- Tobacco:
  - Increases levels of insulin-antagonistic hormones
  - Impairs insulin sensitivity.
4. Reproductive Outcomes

- Adverse effects include:
  - Damage to the umbilical cord structure
  - Miscarriage
  - Increased risk for ectopic pregnancy
  - Low birth weight
  - Placental abruption
  - Preterm birth, and
  - Increased infant mortality.

- Reproductive toxicants are: Nicotine, Areca nut, PAHs and metals – particularly arsenic, cadmium, lead and mercury.
5. Conditions of the Nasal Cavity

• Mainly from Inhaled toxins and tar particles from snuff and smoked products.

• High concentration of free radicals which induce oxidative stress and inflammation, producing primary ciliary dyskinesia.

• Sino-nasal diseases, particularly sinusitis and rhinitis are common in smokers.
6. Sexual Disorders

• **Men** - declines in fertility and sexual potency.

- Women:
  - Decreased Libido
  - Increased cardiovascular disease, while using oral contraceptives
  - Early menopause
7. Addiction

- Tobacco - first step towards additional substance use
  - Especially in younger age groups.

- Smokers sometimes switch to smokeless forms as a substitute.
8. Dental Conditions

- Besides malignant and potentially malignant lesions, other conditions are:
  - Smoker’s melanosis
  - Keratotic patches
  - Nicotinic stomatitis
  - Palatal erosions, and
  - Periodontal disease

*Smoking during pregnancy may develop *Cleft Lip* in the fetus.*
9. Other Consequences

• The variety of consequences has been referred to as ‘diminished health status’ (WHO, 2004).

• Physiologic markers include:
  • Increased oxidative stress,
  • Increased inflammation,
  • Impaired immune status, and
  • Altered lipid profiles.
• Effects are:
  • Poorer Overall Health Related Quality of Life (HRQoL)
  • Impaired Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL)
  • Low Bone Density and frequent fractures
  • Chances of Age related Macular Degeneration (AMD)
  • Poorer sense of Taste and Smell
  • Accelerated ageing
  • Increased absenteeism
  • Decreased work productivity
10. Passive Smoking

*Sidestream Smoke*: Smoke originating from the cigarette

*Mainstream Smoke*: Smoke exhaled by the smoker

- Caused 600,000 premature deaths (28% among children).
- Among the adult deaths, about 64% were women.
There is no risk-free level of exposure to Passive Smoke.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invasive Meningococcal Disease in Children</td>
<td>2.18 (1.63, 2.92)</td>
</tr>
<tr>
<td>Cervical Cancer</td>
<td>1.73 (1.35, 2.21)</td>
</tr>
<tr>
<td>Pharyngeal carriage for Meningitides</td>
<td>1.68 (1.19, 2.36)</td>
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<tr>
<td>Pharyngeal carriage for Pneumonia</td>
<td>1.66 (1.33, 2.07)</td>
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<tr>
<td>Food Allergy</td>
<td>1.43 (1.12, 1.83)</td>
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<tr>
<td>Lower respiratory infections in Infancy</td>
<td>1.42 (1.33, 1.51)</td>
</tr>
<tr>
<td>Childhood asthma</td>
<td>1.32 (1.23, 1.42)</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>1.27 (1.17, 1.37)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.25 (1.12, 1.38)</td>
</tr>
<tr>
<td>Allergic Rhinitis</td>
<td>1.09 (1.04, 1.14)</td>
</tr>
<tr>
<td>Allergic Dermatitis</td>
<td>1.07 (1.03, 1.12)</td>
</tr>
</tbody>
</table>
Quit... Please!

**Timeline of Quitting Benefits**

At 20 minutes after last cigarette: blood pressure and pulse rate drops; body temperature rises toward normal.

At 12 hours after quitting: carbon monoxide level in blood drops to normal; oxygen level rises to normal.

After 2 weeks to 3 months: circulation improves; walking becomes easier; lung function improves; heart attack risk decreases.

After 1 to 9 months: decrease in coughing, sinus congestion, fatigue, shortness of breath.

After 1 year: excess risk of coronary heart disease is decreased to half that of a smoker.

After 5 to 15 years: stroke risk is reduced to that of people who have never smoked.

After 10 years: risk of lung cancer drops to as little as one-half that of continuing smokers; risk of cancer of the mouth, throat, esophagus, bladder, kidney, and pancreas decreases; risk of ulcer decreases.

After 15 years: risk of coronary heart disease is now similar to that of people who have never smoked; risk of death returns to nearly the level of people who have never smoked.
Conclusion

• The Tobacco Epidemic is huge.

• Prevention of Risk Factors is the key

• Cessation is vital.

• The world is slowly coming together against tobacco now!
"It doesn't matter how old you are or how long you've smoked. You become healthier and stronger each day you are tobacco free."

National Cancer Institute
(USA)