Activated Charcoal: Is it Really Necessary?

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History

- Charcoal has been used for medical purposes for thousands of years. The Egyptian papyri document the use of charcoal to 1500 BC.
- The ancient Egyptians used charcoal to adsorb the odor from rotting wounds.
- Hindu documents from 450 BC record the use of charcoal and sand filters for the purification of drinking water.
- Hippocrates who lived from 460-370 B.C. the use of charcoal in treating diseases is a product of long years of scientific studies.

- In 1773, Scheele recognized the specific adsorptive powers of charcoal had with various gasses.

- This led to a much cited bold demonstration by a pharmacist named Touery in 1831. At a meeting at the French Academy, he ingested several times the lethal dose of strychnine with equal amounts of charcoal, and survived.

- In 1963, Holt published a review article in the Journal of Pediatrics entitled 'The black bottle', that activated charcoal became more widely accepted in the management of ingested toxins.

Other uses of Activated Charcoals were as follows:

- Adsorbs poisons and chemicals
- Purifies and cleanses impurities in the blood
- Stimulates digestion and improves appetite
- It remove odors
- Relieves nausea and vomiting
- It relieves rheumatism
- Relieves diseases of the eyes and the ears
- It also relieve coughs and other lung problems
- Relieves pain and aches
- Stops the growth of bacteria
- Lowers body temperature

WHAT IS ACTIVATION ?

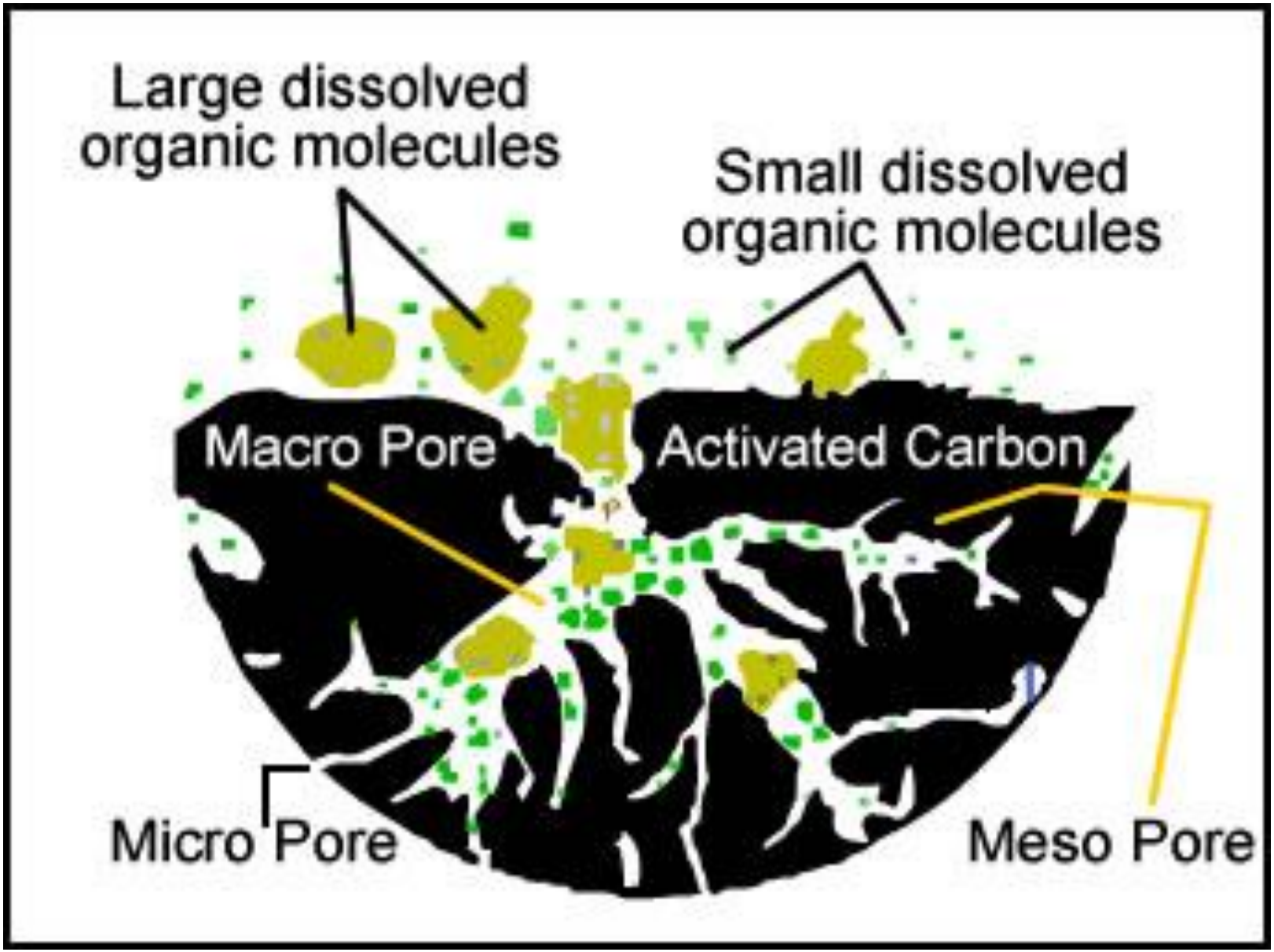
- The term “activation” refers to a carefully controlled oxidation of carbon atoms in the raw material that greatly expands the material’s internal surface area.

- We often speak of the absorbtion surface of carbon, which can vary from 400 – 1600 sq. meter per gram, as a measure of the effectiveness of carbon.

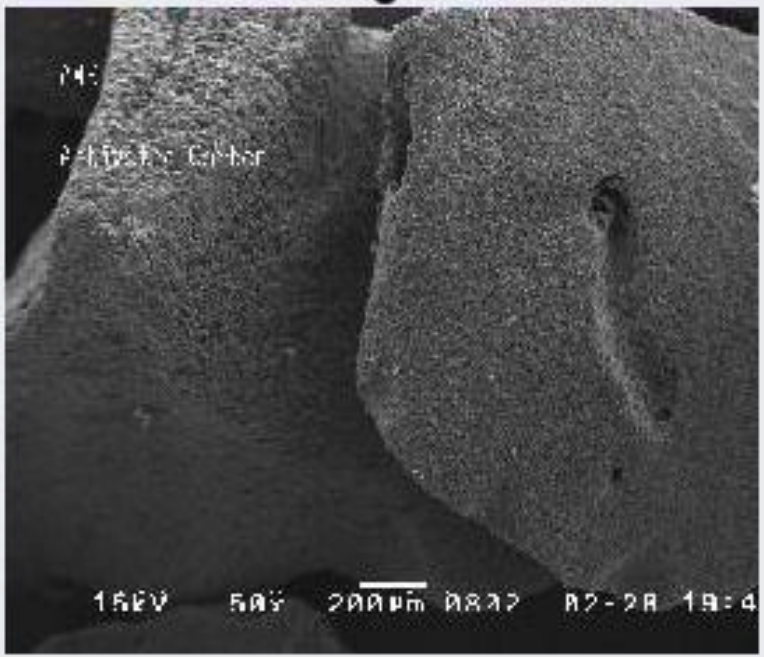
- **This is incorrect!!!!!!**

- The effectiveness of carbon depends on its ability to absorb a certain substance or substances , depending on the physical properties that carbon possesses.

- The activation process forms a network of pores that extend from the ones that naturally occur in the carbonaceous raw material.
- Activation results in a distribution of pore sizes and shapes that depend on the nature of the starting material and on the details of the manufacturing process.
- Macroscale pores are greater than 50 nm in size, while mesoscale pores range from2–50 nm and microscale pores less than 2 nm wide.


Large dissolved organic molecules
Small dissolved organic molecules
Macro Pore
Activated Carbon
Micro Pore
Meso Pore

50 x magnification



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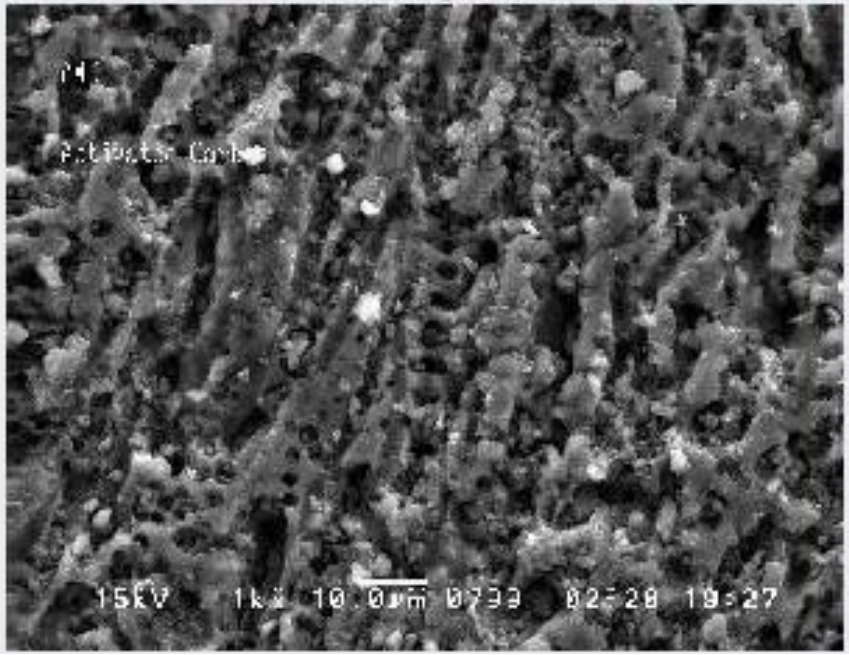

The most common raw materials for manufacturing activated carbon are;

- Coal,
- Coconut shells,
- Wood,
- Peat
- Petroleum coke

Application Forms

- The most common product forms of activated carbon include the following types:

- extruded (usually in the form oncylindrical pellets),
- granular activated carbon and
- powder activated carbon (in specified particle sizes).

- Activated carbon finds extensive use as an adsorbent for the removal of a wide range of contaminants from liquids and gases.
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- It is also used to adsorb a product, such as a solvent, from a process stream, with the adsorbed product being subsequently desorbed onsite for reuse.

Adsorption

- As with other sorbent materials, activated carbon works when molecules adhere to its surface in an adsorption process.
- Adsorption can be thought of as the accumulation of gaseous components, or solutes dissolved in liquids, onto a solid surface.
- It is primarily a physical process (substances do not undergo chemical reactions with the adsorbent).
- If chemical agents are applied to an adsorbent, they may react with solutes in a process known as chemisorption, in which the deposited substances are chemically altered.

Factors Affecting Adsorption

- Molecular size of the substances to be removed from the bulk material
- Hydrophilic behavior of the substances to be removed
- Polarity of the substance to be removed
- Size of interior surface area of the adsorbent material
- Pore structure of the activated carbon material (shape, size distribution)
- Solute concentration
- Temperature and pressure
- Composition of the solution or gas mixture exposed to the adsorbent
- pH value of the solution (for liquid phase)
- Relative humidity

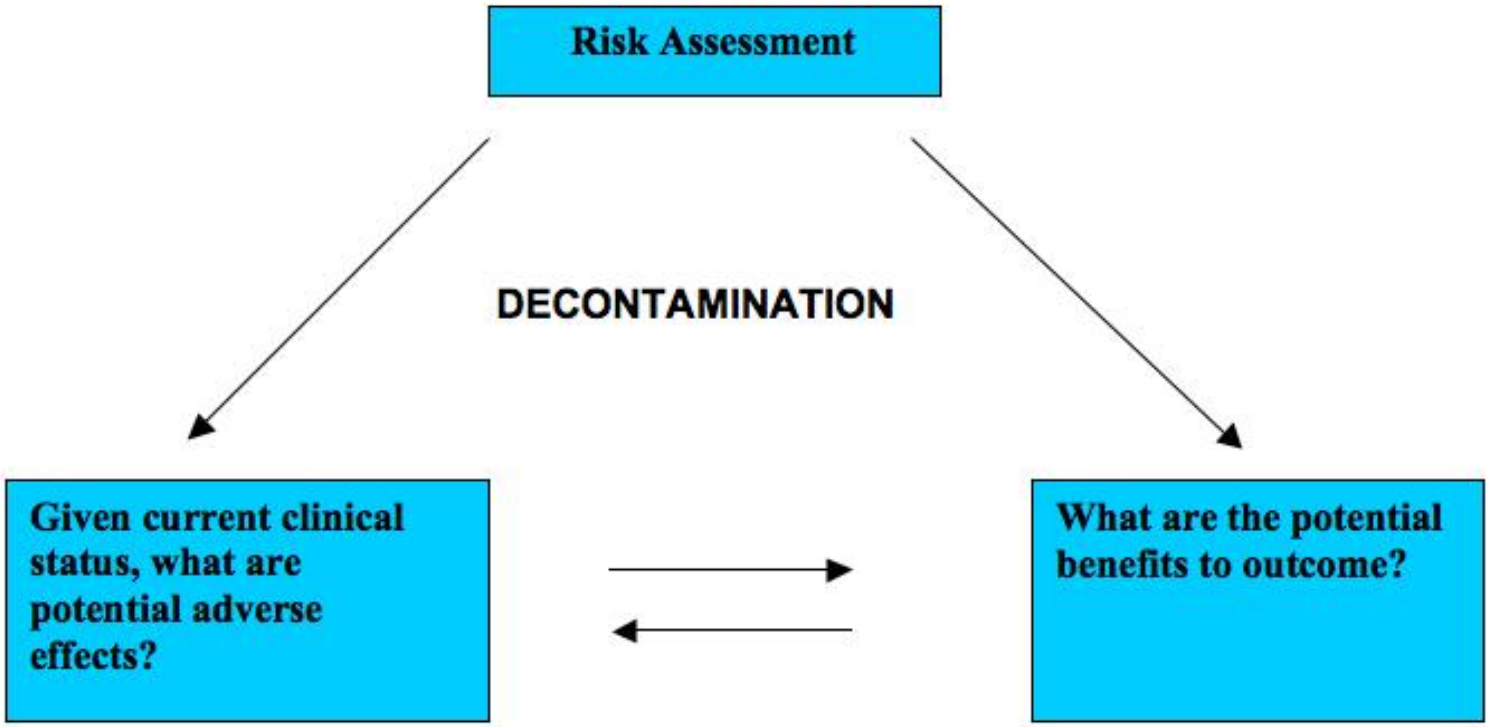
- For decades, activated charcoal has been used as a ‘universal antidote’ for the majority of poisons because of its ability to prevent the absorption of most toxic agents from the gastrointestinal tract and enhance the elimination of some agents already absorbed.

Why do we use in medicine?

- Activated charcoal has been used for the last century for gastric decontamination.

- It prevents absorption of substances in the gastrointestinal tract, thereby decreasing systemic absorption of potentially toxic agents.

Bailey's gastrointestinal decontamination triangle



- Both syrup of ipecac and gastric lavage, once common modalities of decontamination, are no longer recommended as they have not been shown to improve clinical outcome and may actually cause the patient harm.

- The preferred method of gastrointestinal decontamination in awake patients with an intact airway is activated charcoal.

One More Question

- Is charcoal truly the 'universal antidote' or will it go the way of 'the medical anecdote'?
- Cost or benefit evaluation!!!!

- The American Academy of Clinical Toxicology and the European Association of Poison Centres and Clinical Toxicologists remind us that;
- activated charcoal should not be given routinely in the treatment of poisoned patients.

LIST OF ADSORBED TOXINS

Agents WELL Adsorbed by Activated Charcoal				Agents POORLY Adsorbed by Activated Charcoal
Acetylsalicylic Acid	Chloroquines	Indomethacin &	Phenylbutazone	Cyanide
Aflatoxin	& Primaquine	other NSAIDs	Phenylpropanolamine	Ethanol
Amphetamines	Cimetidine	Kerosene, Benzene,	Piroxicam	Ethylene Glycol
Antidepressants	Dapsone	Dichloroethane	Phenol Syrup of	Iron
Antiepileptics	DDT	Malathion & other Pesticides	IPECAC constituents	Isopropanol
Antihistamines	Dextropropoxyphene	Meprobamate	Quinidine & Quinine	Lithium
Aspirin/	& other opioids	Nefopam	Strychnine	Methanol
Other Salicylates	Digitalis	Methotrexate	Tetracyclines	Strong Mineral Acids & Alkali
Atropine	DIQUAT &	Mexiletine	Theophylline	
Barbiturates	other Herbicides	NSAIDS	Torbutamide,	
Benzodiazepines	Glycosides Disopyramide	(e.g. Tolfenamin Acid)	Chlorpropamide	
Beta-blockers	Ergot Alkaloids	*Paracetamol	Carbutamide,	
Biphenyls	Furosemide	PARAQUAT	Tolazamide	
Carbamazepine	Glibenclamide & Glipizide Glutethimide	Polychlorinated Phenothiazines		

** In cases of severe paracetamol poisoning, concurrent intravenenous antidote (N-acetylcysteine) administration and oral Norit Carbomix is recommended.*

Recommended dosage of activated charcoal

Children up to 1 year of age	10–25 g or 0.5–1.0 g/kg
Children 1–12 years of age	25–50 g or 0.5–1.0 g/kg
Adolescents and adults	25–100 g

Activated charcoal not helpful/caution/contraindicated

PHAILS

P – Pesticides, petroleum distillates, unprotected airway
H – Hydrocarbons, heavy metals, >1 h
A – Acids, alkali, alcohols, altered level of consciousness, aspiration risk
I – Iron, ileus, intestinal obstruction
L – Lithium, lack of gag reflex
S – Solvents, seizures

Treatment Modalities

- **SINGLE-DOSE THERAPY**

- **Activated charcoal** should be administered unless it is known that the drug ingested is not bound by **charcoal.**

- Patients often ingest multipl agents. **Activated charcoal** is usually indicated if any of the drugs are adsorbed by **charcoal** (e.g., a lithium and phenytoin ingestion).

Treatment Modalities

- **MULTIPLE-DOSE THERAPY**
- In general, multiple-dose therapy is recommended in cases of phenobarbital and theophylline intoxication.
- Other commonly proposed indications for multiple-dose therapy include ingestion of sustained-release formulations and when bezoar formation is suspected (e.g., rising salicylate levels despite appropriate decontamination and urinary alkalinization).
- Enhanced elimination, but not clinical efficacy, has been demonstrated for carbamazepine, chlordecone, cyclosporine, dapsone, digitoxin, meprobamate, nadolol, phenylbutazone, phenytoin, quinine, salicylate, and valproic acid.

SWANSON®
PREMIUM BRAND
bringing wellness to the world since 1969
Activated Charcoal
capsules

Activated Charcoal Gel
IVOMAC
Vets Plus, Inc.

EMERGENCY TREATMENT FOR POISONING. IF POSSIBLE, CALL A POISON CONTROL CENTER, EMERGENCY MEDICAL FACILITY, OR HEALTH PROFESSIONAL FOR HELP BEFORE USING. IF HELP CANNOT BE REACHED QUICKLY, FOLLOW LABELED DIRECTIONS.

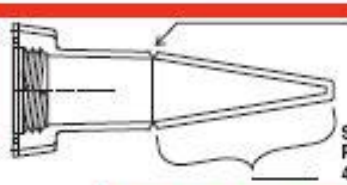
EMERGENCY
PHONE NO.:

PADDOCK LABORATORIES, INC.
MINNEAPOLIS, MN 55427
NDC 0574-0120-76

Actidose
with Sorbitol™
ACTIVATED CHARCOAL SUSPENSION

50 grams Activated Charcoal
96 grams Sorbitol

Paddock Laboratories, Inc.



SHAKE WELL BEFORE USING

CONTENTS: 240 mL (8 Fl Oz)

THIS END UP WHEN CUTTING TIP

N 3 0574-0120-76 7

Read label warnings and directions immediately upon buying this product. Write emergency phone number(s) in space provided.

CONTAINS: 50 grams (208 mg/mL) activated charcoal and 96 grams (400 mg/mL) sorbitol in a unique suspending vehicle.

INDICATIONS: For emergency use to adsorb ingested poisons.

ACTIONS: ACTIDOSE WITH SORBITOL adsorbs toxins from the gastrointestinal tract and inhibits the absorption of poisons. ACTIDOSE WITH SORBITOL contains sorbitol which provides an osmotic cathartic effect to promote gastrointestinal tract evacuation and to prevent constipation and compaction.

DIRECTIONS: SHAKE WELL BEFORE USE. 1) Snip tapered tip as indicated above and remove. 2) Holding the tube upright, carefully cut off tube closure. 3) Reattach tapered tip and connect to any charcoal administration set or squeeze contents in a cup and have patient drink entire contents. USUAL SINGLE DOSE: Adults and children over 12 years of age: 50 grams of activated charcoal (1 tube). Do not use this product in children weighing less than 16 kg (35 lb).

Keep patient active and moving. Save the container of poison. If previous attempts to contact poison control center, emergency medical facility, or health professional were unsuccessful, keep trying.

WARNINGS: If patient has been given ipecac syrup, DO NOT give ACTIDOSE WITH SORBITOL until after last vomiting episode. Do not use in persons who are not fully conscious. Do not use this product unless directed by a health professional, if turpentine, corrosives, such as alkalies (lye) and strong acids, or petroleum distillates, such as kerosene, gasoline, paint thinner, cleaning fluid or furniture polish have been ingested. This product is not recommended for use in children weighing less than 16 kg (35 lb), or during multiple dose activated charcoal therapy since excessive catharsis and significant fluid and electrolyte abnormalities may occur.

STORE AT ROOM TEMPERATURE 15°-30°C (59°-86°F.)

DO NOT REFRIGERATE.

CAUTION: KEEP OUT OF REACH OF CHILDREN.

TAMPER EVIDENT: SEALED TUBE. DO NOT USE IF TUBE HAS BEEN OPENED OR PUNCTURED. 132938 (07-95)

Time of Administration

- Several studies have confirmed that the 1 h time frame for the administration of charcoal to have its best efficacy often cannot be achieved in the 'real' clinical setting.

- Currently, some poison control centers advise home administration of activated charcoal for pediatric ingestions. In addition, some prehospital personnel administer activated charcoal.

Is Activated Charcoal Really Necessary ?

- **In vitro studies**
- **Volunteer studies**
- **Clinical studies**

In vitro studies

- Many in vitro studies produce results which can, however, not be applied directly in clinical situations.
- Neuvonen and Olkkola showed that; most metals, like lithium and iron, are not efficiently adsorbed by charcoal.
- Andersen showed that; acids are best adsorbed by charcoal in an acidic environment and bases in an alkaline environment. And the adsorption of aspirin, quinidine, and amitriptyline was also dependent on pH.
- The most important factor seems to be the charcoal-drug ratio. At a ratio of 10:1, 90 to 100% of most drugs is adsorbed by charcoal in in vitro conditions.

Volunteer studies

- In order to standardise many factors possibly affecting the adsorption capacity of charcoal, such as gastric contents and other drugs taken simultaneously, most studies are performed with healthy volunteers.

- The difficulty of comparing these volunteer studies with each other involves the differing time-intervals between ingestion of a drug and of charcoal as well as the differing doses and qualities of the charcoal.

- Levy and Houston; The first volunteer studies as well as clinical recommendations involved small amounts of charcoal, which made charcoal seem ineffective.

Volunteer studies

- In the study of Yeates and Thomas a dose of 50 g was able to reduce the absorption of paracetamol by 56% even 1 h after the ingestion.

- Another important factor affecting the capacity of charcoal to adsorb drugs is the time interval between drug ingestion and charcoal ingestion. In volunteer studies, this time interval has varied from 0 to 360 minutes.

- When data from over 100 different studies concerning 43 drugs are summarised, it seems evident that the effect of charcoal diminishes with increasing time-interval.

Volunteer studies

- Laineet et al. showed that;The formulation of the drug affects the antidotal efficacy of charcoal together with timeinterval, and the reduction in absorption of sustained-release formulations may still be significant 4 h after ingestion of the drug.

- In the study of Rosenberg et al, activated charcoal was superior to whole-bowel irrigation when the treatment was started immediately after the ingestion of aspirin tablets; charcoal reduced the absorption by 79%, whereas whole-bowel irrigation reduced it by only 24%.

Clinical studies

- Underhill et al. there are many difficulties in conducting a proper clinical study with poisoned patients, the number of such trials is very limited. Only one well-conducted clinical trial used activated charcoal in only one study arm.

- Compared charcoal with gastric lavage, or ipecac-induced emesis, with 60 patients who had taken a paracetamol overdose randomised to receive either charcoal, lavage, emesis, or no treatment at all.

Clinical studies

- The no-treatment group was halted for ethical reasons in the middle of the study. The others were followed and paracetamol plasma levels were measured. The mean fall in paracetamol plasma level was 52%, 39%, and 41% for charcoal, lavage and emesis, respectively. Only charcoal results differed significantly from those of the other treatments.

RESULT

- The international Position Statement (AACT, EAPCCT) states that;

  benefit from the use of charcoal has not been satisfactorily demonstrated, and charcoal may be considered only if a patient has ingested a toxic amount of poison up to 1 h previously.

Activated Charcoal

- This is the best, until we produce a better one….

EFFORTS

NEVER

FAIL

- THANKS FOR YOUR PATIENCE