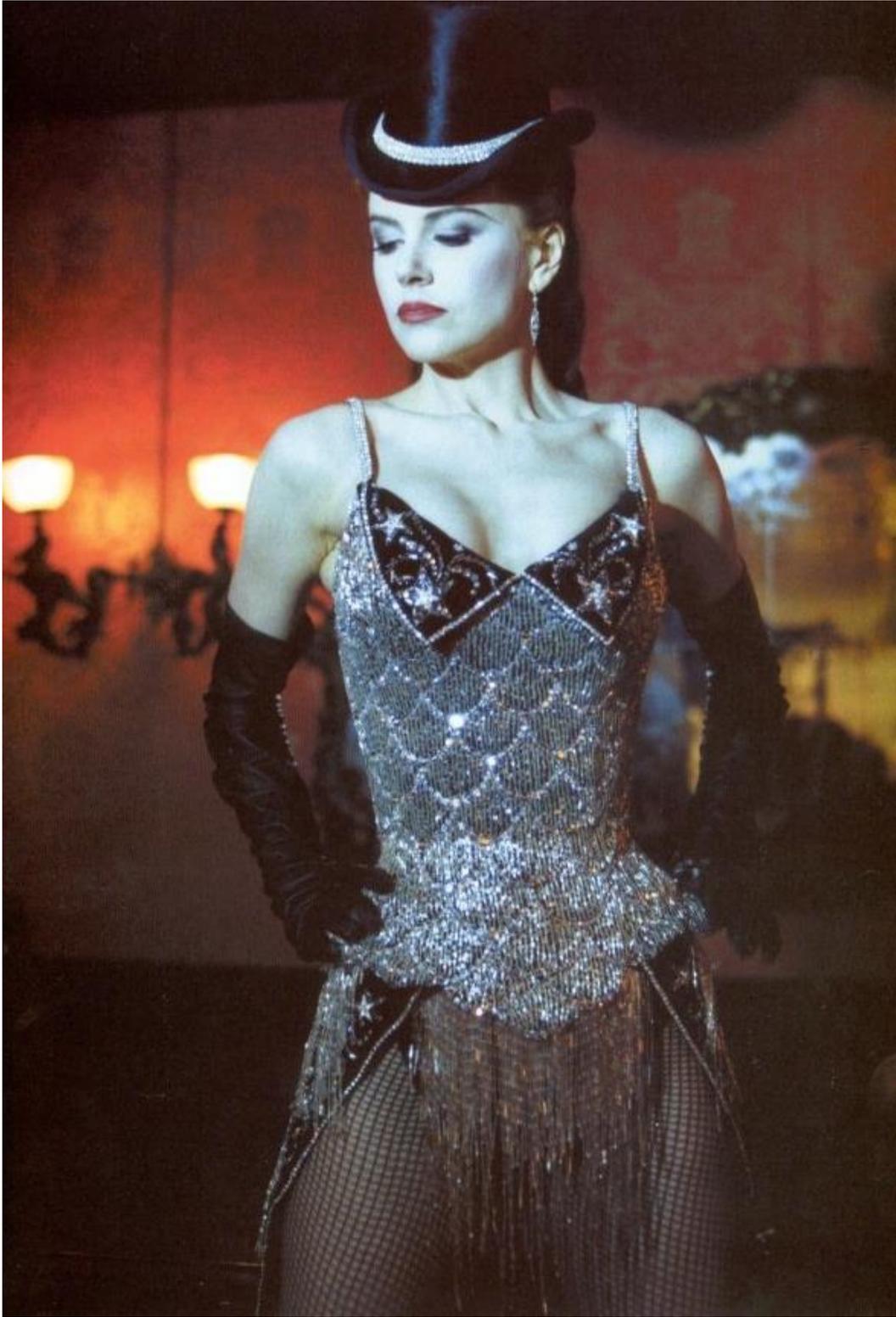


CHARCOAL



“Satine” (Nicole Kidman “Moulin Rouge”, 2001)

*The French are glad to die for love.
They delight in fighting duels.
But I prefer a man who lives
And gives expensive jewels.
A kiss on the hand
May be quite continental,
But diamonds are a girl's best friend.*

*A kiss may be grand
But it won't pay the rental
On your humble flat
Or help you at the automat.*

*Men grow cold
As girls grow old,
And we all lose our charms in the end.*

*But square-cut or pear-shaped,
These rocks don't lose their shape.
Diamonds are a girl's best friend.*

*Tiffany's!
Cartier!
Black Starr!
Frost Gorham!
Talk to me Harry Winston.
Tell me all about it!*

*There may come a time
When a lass needs a lawyer,
But diamonds are a girl's best friend.*

*There may come a time
When a hard-boiled employer
Thinks you're awful nice,
But get that ice or else no dice.*

*He's your guy
When stocks are high,
But beware when they start to descend.*

*It's then that those louses
Go back to their spouses.
Diamonds are a girl's best friend.*

*I've heard of affairs
That are strictly platonic,
But diamonds are a girl's best friend.*

*And I think affairs
That you must keep liaisonic
Are better bets
If little pets get big baguettes.*

*Time rolls on,
And youth is gone,
And you can't straighten up when you bend.*

*But stiff back
Or stiff knees,
You stand straight at Tiffany's.*

*Diamonds! Diamonds!
I don't mean rhinestones!
But diamonds are a girl's best friend*

"Diamonds are a Girl's, Best", Friend, 1953



In fin de siècle of La Belle Epoch, Satine was the star of the Moulin Rouge, the talk of all of Paris. She could have any man she wanted and she wanted the Duke, not for any particularly admirable traits, just for his promises of fabulously expensive diamonds. Indeed the Duke was a totally horrid person. She was not in the least in love with him, however, but rather she was in love with Christian, the young Bohemian and penniless playwright. In the end Satine came to realize that diamonds are only an illusion and they did not bring her true happiness at all. She rejected the Duke and eloped with her playwright true love. For a brief moment she is truly happy...before her tragic and untimely death, from the white death.

Elemental carbon comes in several forms. As diamonds it failed to live up to Satine's hopes for happiness. The form that Emergency physicians once held the high hopes of happiness for was activated charcoal. This was to be the "panacea" for overdose cases. Like Satine's diamonds however, these hopes have not been entirely fulfilled. Although based on sound principles for the treatment of overdoses it has not to date been decisively proven to result in reduced mortality for any poison. Therefore when considering the use of charcoal in an overdose case, the potential benefits for a happy outcome, like the promises of the Duke must be weighed against the potential drawbacks.



CHARCOAL

Single dose activated charcoal is used in toxicology as an effective **GIT decontaminant** in selected cases **where benefit is likely to outweigh the risk of administration**.

Multidose **activated charcoal** is used in toxicology in selected cases to **enhance toxic drug elimination**.

Charcoal is more effective at reducing absorption of drugs than **ipeccac** or **lavage**.

Oral activated charcoal is the current preferred method of GIT decontamination

SINGLE DOSE ACTIVATED CHARCOAL

Introduction

Activated charcoal is prepared by the super heating of distilled wood pulp.

The resulting fine porous particles are then suspended in water or sorbitol.

The very large surface area provided by these particles then act as an effective adsorbing surface for drugs and toxins, and so aid in the prevention of their systemic absorption

Charcoal dosing may be given as:

- **Single dosing.**
- **Multiple dosing.**

Preparations

Activated charcoal as:

Carbosorb Plain:

- 50gm / 300mls

Carbosorb S (Charcoal & Sorbitol Suspension):

- 50gm / 300mls charcoal and sorbitol solution as 70% aqueous suspension.

Mechanism of Action

Activated charcoal is an inert substance with a **very large surface area**.

Substances are **adsorbed** (or attached) onto this surface *reversibly* and hence the substance cannot be absorbed (move across tissues), from the gut.

Some preparations used to contain sorbitol (a cathartic), to reduce GIT transit time and hence reduce the time available for systemic absorption. **The benefit of this has not been proven however.**

Pharmacodynamics

Human volunteer studies confirm that oral activated charcoal reduces drug absorption when given up to **4 hours** after ingestion but is *most effective when given immediately after ingestion.*

However, oral activated charcoal has not to date been shown to improve clinical outcome when applied to unselected patients with self-poisoning and should **not** be regarded as routine.

Activated charcoal is most *likely* to benefit a selected subgroup of patients with severe poisoning in whom the benefit is likely to outweigh the risks of its administration.

Pharmacokinetics

Absorption:

- Activated charcoal is administered orally or by nasogastric tube.

Distribution

- Activated charcoal is not absorbed by the GIT. It is confined within the lumen of the GIT.

Metabolism and excretion:

- Activated charcoal is not metabolized by the body. It is eliminated via the GIT.

Indications

Activated charcoal in general terms is the preferred method of GIT decontaminated, (compared to emesis and gastric lavage)

There is no current evidence that the administration of activated charcoal improves clinical outcomes therefore it should not be administered *routinely*, especially for minor overdoses in children, who will usually require a (distressing) NG tube for its administration.

The administration of activated charcoal should in consequence be considered in the light of possible benefit versus the possible complications of its use.

The following criteria should be met:

1. The substance is toxic:

Especially important examples, are those with **high lethality** and **no effective antidotes**.

Examples include

- **Paraquat** (see Paraquat poisoning in Toxicology folder)
 - **Colchicine** (see Colchicine poisoning in Toxicology folder)
2. The substance is known to be adsorbed by charcoal.
 3. In patients who are **not** intubated, the substance has not caused or is **not likely to cause** seizures or a significant depression in the conscious state.
 4. Ingestion has occurred within **one hour**. (After this time, there is insufficient clinical data to support or exclude its use).

Charcoal is **not** effective for:

1. Elemental metals and simple ions:
 - Iron, lithium, lead, potassium, arsenic, mercury, cyanide.
2. Corrosives:
 - Acids
 - Alkalis
3. Alcohols:
 - Ethanol, methanol, isopropyl alcohol, ethylene glycol.
4. Hydrocarbons

Contra-indications

These include:

1. **Seizures or an altered conscious state, (unless the airway is protected by prior intubation) or a high likelihood of these occurring.**
 - Charcoal is safe to give in **intubated** patients.
2. Non-toxic ingestions.
3. Sub-toxic ingestions.

4. A clinical risk assessment that indicates a good outcome with supportive care and/ or anti-dote therapy alone.
5. Any corrosive substance.
 - In these cases any subsequent vomiting will place the esophagus and airway at further risk, from re-exposure.
6. Substances likely to induce significant pneumonitis due to aspiration, (eg. eucalyptus oil or hydrocarbons).
7. GIT obstruction:
 - Note that ileus is not a contra-indication to **single dose** activated charcoal. ¹
8. Combative and uncooperative patients.

Adverse Effects

1. **Aspiration:**

Charcoal is non-toxic and inert, the main problem will be **hypoxia**.

- The possible benefits of giving charcoal must be weighed against the possibility of aspiration.
- Misplacement of a nasogastric tube into the lungs represents a particular hazard in this regard, (and a potentially fatal one).

2. Unpalatable:

- A significant number of patients will have **vomiting**, (about 30% within one hour) ¹

3. Sorbitol induced diarrhea:

- Preparations with sorbitol may result in an osmotic diarrhea resulting in fluid and electrolyte disturbances, hence should not be used in children or dehydrated patients, or in repeated doses. It should be noted that the benefit of the addition of sorbitol has **not** been proven and it is not generally recommended.

4. Charcoal bezoar formation:

- Formation of “concretions”, especially with repeat usage. In this scenario the charcoal may act as a reservoir for re-release of the drug!

5. Impairment of absorption of any subsequent orally administered drugs.

Dosing

Charcoal is most commonly given as a single dose.

In selected cases multiple dosing may be beneficial, (see below).

Single dosing:

Adults:

- 50 gms orally or via N/G tube.

Children:

- 1 gm / kg (to a maximum of 50 grams) orally or via nasogastric tube.

The optimal dose of charcoal, however, is unknown.

Charcoal can be mixed with ice cream to make it more palatable for children.

Nasogastric charcoal can be given in intubated patients once the position of the nasogastric tube has been confirmed to be within the stomach.

Note that in **highly lethal situations**, such as **paraquat** or **colchicine** ingestion, an uncooperative patient may require intubation specifically for charcoal administration.

MULTIPLE DOSE ACTIVATED CHARCOAL (MDAC)

Introduction

MDAC, (**multiple dose activated charcoal**) is of some use in a small number of specific situations.

Mechanism of Action

Repeat administration of activated charcoal will progressively line the entire lumen of the gut.

This process can enhance drug elimination by:

1. **Interruption of enterohepatic circulation:**

A number of drugs are excreted via the bile, but then reabsorbed via the gut. Charcoal within the small intestine will prevent this gut reabsorption.

For this method to be effective the drug must not only undergo enterohepatic reabsorption, but should also have a relatively small volume of distribution.

2. **A gastrointestinal dialysis effect:**

The charcoal binds the drug, helping to maintain a concentration gradient from the relatively high intravascular compartment to the relatively lower intra-luminal compartment.

For this method to be effective the drug must be a small molecule, lipid soluble, have a small volume of distribution and have low protein binding.

Indications

MDAC is thought to be clinically useful for the following drugs:

1. Carbamazepine coma.
 - This is currently the commonest indication for MDAC
 - Reduces ventilation and ICU time.
2. Phenobarbitone coma:
 - Reduces ventilation and ICU time.
3. Dapsone overdose causing methemoglobinemia (rare)
 - May reduce the period of methemoglobinemia.
4. Quinine overdose

5. Theophylline overdose

Contra-indications

1. Decreased or anticipated decrease in conscious state in unintubated patients.
2. Bowel obstruction/ ileus (check for bowel sound prior to administration).

Adverse Effects

1. Vomiting
2. Aspiration
3. Bowel obstruction, from charcoal bezoar formation.

Dosing

Repeat dosing:

Nasogastric charcoal can be given in intubated patients once the position of the nasogastric tube has been confirmed to be within the stomach.

Give initial dose as above:

Then repeat doses at:

- 25 grams (0.5 gm/kg for children), **every 2 hours.**

Check for bowel sounds prior to each dose. The dose should be withheld if bowel sounds are not detected.

Reconsider the indications and clinical end points for therapy every 6 hours. MDAC should rarely be required beyond 6 hours.



The evil Duke showers Satine with priceless diamonds



The penniless playwright, Christian, declares his love for Satine.



Love finally triumphs as Satine (Nicole Kidman) exchanges her diamonds for her true love, Christian, (Ewan McGregor).

References:

1. GIT Decontamination in: Murray L et al. Toxicology Handbook 3rd ed 2015.

Dr J Hayes

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