
Effect of Sulphate Cathartics on Adsorption of Rifampicin to Activated Charcoal

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Accepted 12 April 2001
Revised 27 March 2001
Received 27 March 2000

The effect of magnesium sulphate and sodium sulphate on the *in vitro* adsorption of rifampicin to activated charcoal (AC) was investigated. Solutions of rifampicin alone and rifampicin with 7.5 mg/ml cathartic solution were vortex mixed for 30 s with different quantities of AC, incubated for 30 min at 37° and analyzed for free rifampicin spectrophotometrically at 320 nm. Addition of sodium and magnesium sulphates significantly increased ($P<0.05$) the adsorption of rifampicin to activated charcoal. In all, the adsorption obeyed quantity-dependent kinetics.

The ability of activated charcoal to adsorb poisons and drugs has been extensively demonstrated hence its use in poison management¹⁻³. Also evidences are widely available in literature, which demonstrate on the ability of activated charcoal to adsorb antibiotics⁴⁻⁶. The safety of activated charcoal is remarkable being non reactive and is not absorbed in the gastrointestinal tract. Oral administration of activated charcoal often results in occasional constipation and combined administration of charcoal with sufficient dose of cathartic such as sodium or magnesium sulphate or sorbitol will result in charcoal laden stool in most patients⁷⁻⁹. Sulphates cathartics are usually co-administered with activated charcoal to prevent constipation or impaction¹⁰⁻¹¹. Hence we set out investigate the effect of sodium and magnesium sulphates on the ability of activated charcoal to adsorb rifampicin.

Activated charcoal (Ultra carbon Merck) sodium sulphate and magnesium sulphate (reagent grade, BDH, England) were used in this study. Fifty to 800 mg of activated charcoal (AC) were placed in test tubes. Rifampicin solutions of 2.5, 5, 10, 50 and 100 µg/ml concentration were prepared in distilled water. Five milliliters of each solution was added to tubes containing activated charcoal. The resulting rifampicin charcoal slurries were vortex mixed for 30 s, incubated in a water

bath shaken for 30 min at 37°, and centrifuged at 3000 rpm for 5 min. Rifampicin was then determined in the clear supernatant using UV-320 nm Jeneway electrophotometer, England.

In another experiment, the effect of sulphate and magnesium sulphate on the adsorption of rifampicin to AC was investigated. Five milliliters of solutions containing 7.5 mg/ml sodium sulphate, 7.5 mg/ml magnesium sulphate with 2.5, 5, 10, 50 and 100 µg rifampicin/ml were added to test tubes containing 50-800 mg AC. The tubes were vortex mixed, incubated, and centrifuged and analysed similarly as described above.

In all the percentage of rifampicin adsorbed from the original solutions was calculated from the percentage of drug remaining in the supernatant. In all the experiments, duplicates of the results agreed well. The significance of data was determined by statistical analysis at $P<0.05$. The B-50 (amount of AC in mg required to bind 50% of drug at stated concentrations) was determined from a plot of percent of drug bound versus logarithm of concentration of AC¹³.

Figs. 1 and 2 show adsorption of different concentrations of rifampicin to increasing amount of AC and the adsorptive effect of $MgSO_4$ and Na_2SO_4 respectively. As the quantity of AC increased the adsorption of the rifampicin to AC increased and the

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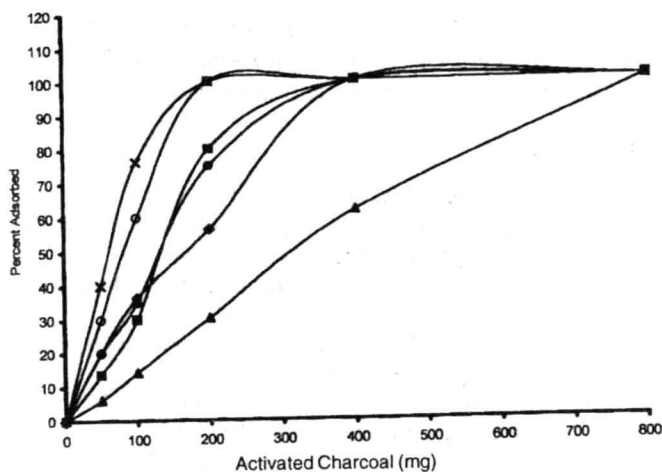


Fig. 1: Effect of sodium sulphate on adsorption of rifampicin to activated charcoal

The effect of sodium sulphate on the adsorption of different concentrations of rifampicin that includes (-◆-) 2.5 µg/ml rifampicin, (-■-) 5.0 µg/ml rifampicin alone, (-▲-) 10.0 µg/ml rifampicin alone (-*-) 2.5 µg/ml rifampicin + sodium sulphate, (-Θ-) 5.0 µg/ml rifampicin + sodium sulphate, (-●-) 10.0 µg/ml rifampicin + sodium sulphate to activated charcoal.

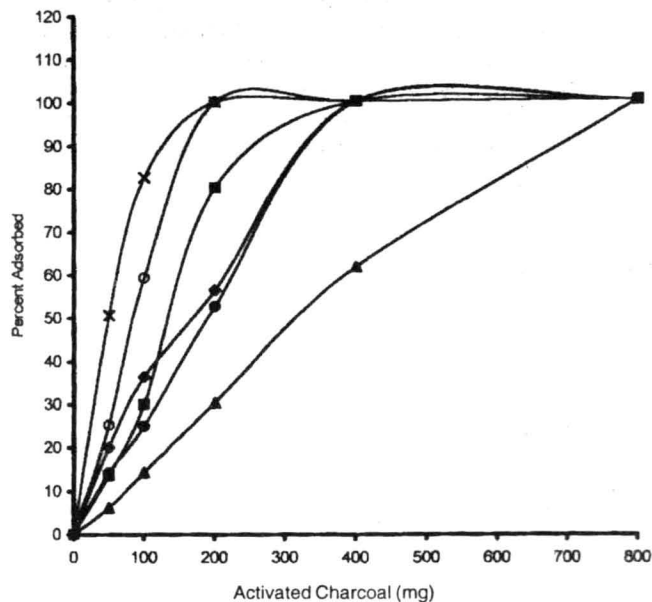


Fig. 2: Effect of magnesium sulphate on adsorption of rifampicin to activated charcoal

The effect of magnesium sulphate on adsorption of different concentrations of rifampicin, such as (-◆-) 2.5 µg/ml rifampicin, (-■-) 5.0 µg/ml rifampicin alone, (-▲-) 10.0 µg/ml rifampicin alone, (-*-) 2.5 µg/ml rifampicin + magnesium sulphate, (-Θ-) 5.0 µg/ml rifampicin + magnesium sulphate, (-●-) 10.0 µg/ml rifampicin + magnesium sulphate to activated charcoal.

addition of the two saline cathartics ($MgSO_4$ and Na_2SO_4) did not alter the quantity dependent adsorption pattern. Figs. 1 and 2 showed leftward shift of the graph of rifampicin with $MgSO_4$ and Na_2SO_4 indicating increased adsorption of rifampicin to AC when compared with rifampicin alone. The B_{-50} values of rifampicin alone and the effect of $MgSO_4$ and Na_2SO_4 on the B_{-50} values is shown on fig. 3 and 4. Treatment with $MgSO_4$ and Na_2SO_4 resulted in decreased amount of AC required to bind 50% of rifampicin at the both therapeutic and simulated toxic concentrations.

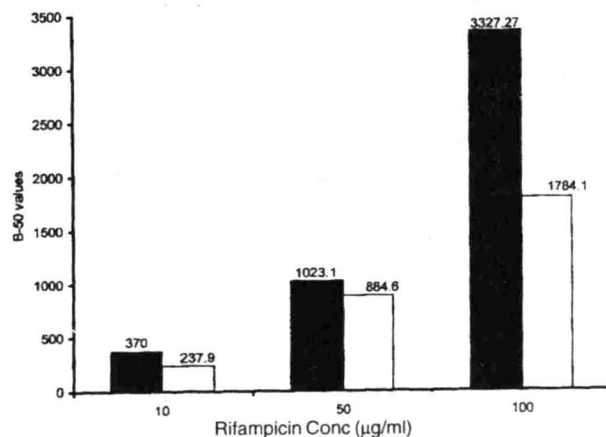


Fig. 3: B_{-50} values of rifampicin and effect of magnesium sulphate

B_{-50} values of rifampicin were determined at 3 concentration levels in the absence (■) and the presence of 7.5 mg/ml of magnesium sulphate (□)

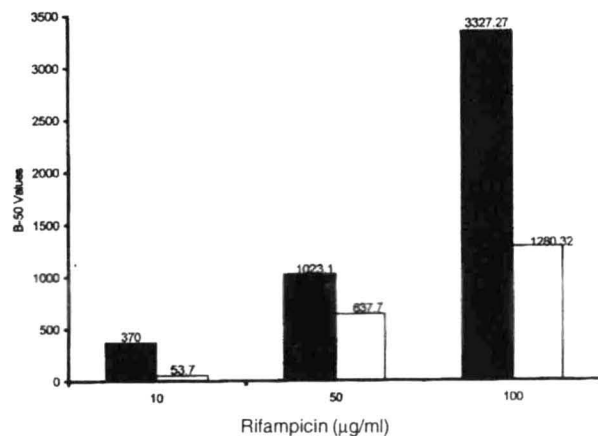


Fig. 4: B_{-50} values of rifampicin and effect of sodium sulphate

B_{-50} values of rifampicin were determined at 3 concentration levels in the absence and (■) presence of 7.5 mg/ml of sodium sulphate (□)

Our results have shown that activated charcoal can absorb rifampicin and this is in conformity with the earlier work of Ibezim *et al.* (1991)⁵ who reported significant increase in ciprofloxacin adsorption to activated charcoal and Orisakwe *et al.* (1996)⁶ who also reported quantity dependent and significant increase in the adsorption of rifampicin to activated charcoal.

The use of activated charcoal in poison management and the ability of activated charcoal to adsorb poisons and drugs have been widely studied and applied^{2,3,6,12}. What might be interesting is find out what needs to be given with activated charcoal to increase its efficacy and probably reduce the dose of activated charcoal in poison management. To this end in this present study, we found a significant increase in adsorptive capacity of AC after addition of MgSO₄ and Na₂SO₄ saline cathartics. This also resulted in lower B-50 values (amount of activated charcoal required to bind 50% of rifampicin in a standard solution).

These findings are in agreement with our previous findings in which we reported that MgSO₄ significantly enhanced the adsorption of quinine to activated charcoal¹³. Goldberg *et al.* (1987) has reported increased adsorption of theophylline to activated charcoal with another saline cathartic sorbitol in the gastrointestinal tract which resulted to reduced area under the curve (AUC) of theophylline¹⁴. We therefore recommend the use of

activated charcoal; and conservative doses of MgSO₄ or Na₂SO₄ in rifampicin overdose especially in cases where constipation or impaction is envisaged.

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