

What is already known on this topic

Thrombolytic drugs are effective at breaking down clots in the body

No scientific data are available on treatment of blood stains on clothing

What this study adds

Thrombolytic drugs and a commercial stain remover were worse at removing blood stains than no pretreatment

Treatment after 2-3 hours produced better results than later treatment

Washing in hot water was more effective than washing in cold water

effective than cold water for most treatments (4.17 *v* 5.61; $P=0.0002$).

Alteplase was significantly less effective than no treatment at all (5.29 *v* 3.68; $P=0.009$), and streptokinase was marginally less effective than no treatment, but this difference was not significant (3.98 *v* 3.68; $P=0.4$). Heparin was significantly less effective than no treatment (5.65 *v* 3.68; $P=0.001$) under all washing conditions as was Neon, the commercial enzymatic stain remover (5.85 *v* 3.68; $P=0.0003$). No interaction or clustering effects were detected.

Discussion

This study shows that treatment of blood stains requires early action, as is the case when treating heart attacks and strokes. Blood stains that were treated within three hours and washed within five hours after deposition were much less prominent than those treated seven hours and washed nine hours after deposition. Interestingly, only two of the 20 stain removal guides reviewed emphasised the importance of acting quickly.^{9 10} One suggested a likely mechanism: "Keep the stain wet."¹⁰

Contrary to the convictions of most experts, it is not a good idea to wash blood stains in cold water. In this study hot water was much more effective. However, as some guides recommended washing in warm water after immediate treatment with cold water,^{8 13} hot water may be harmful only when the blood is fresh.

Unfortunately for the pharmaceutical industry, thrombolytic drugs were not effective stain removers. Application of alteplase, streptokinase, and heparin all made the blood stains worse, although the effect of streptokinase was not significant. This is perhaps a reassuring result as alteplase costs over \$1000 a dose, probably far more than the article of affected clothing. Nevertheless, thrombolytic drugs may still have a role in selected cases. In this study the treatment was applied to the blood stain without any rinsing or rubbing until the

pillowcase was put in the washing machine two hours later. As the primary mechanism of these drugs is to inhibit or reverse coagulation, whereas the mechanism of staining is likely to be cell lysis and haemoglobin deposition, the treatment may help the stain to spread and further infiltrate the fabric fibres. Further research is needed under different conditions to elucidate the role of thrombolytic drugs when fresh blood stains occur in the emergency department.

The most surprising finding of this study was the terrible performance of the commercial stain remover. It was the most detrimental of all treatments studied, even through the product was used according to the manufacturer's instructions and blood was mentioned as one of stains it is able to combat. This result is disappointing because many stain removal guides recommend commercial enzymatic stain removers as the most effective tool against "protein rich" stains such as blood.^{5 6 14} The laundry industry clearly needs to embrace methodologically rigorous research and evidence based principles when developing products and giving advice on stain removal.

Although further research is required, the best advice for hapless casualty officers who find their favourite clothes stained by blood seems to be to eschew all stain removal products as well as the hospital formulary and, as far as possible, to keep the stain wet until washing in hot water as soon as practicable.

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Never too late ...

For many people in Britain, the winter of 1972-3 is remembered for the miners' strike, the "three-day week," power cuts, and reading by candlelight. For Dr Miles Markus, however, more serious matters were brewing. Working at the time in London, he carefully prepared a letter and submitted it for publication to the *British Medical Journal*. The publication process ground slowly at the journal in those days (unlike the smooth, electronic office we

have today?)—so it was not until June that Dr Markus's letter hit the press (1973;ii:666). To his dismay we had spelt his name wrongly, substituting a "c" for the "k." How could this have happened? Dr (now Professor) Markus has nursed his grudge for 27 years, and last month, by an indirect route, we came to hear of his displeasure. We would like to apologise to Professor Markus and wish him a merry Kristmas.