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A or placebo, and early BCG or the usual later BCG. The timing of BCG had no detectable effect on mortality, and—contrary to the authors' initial expectation—they found no interaction between vitamin A and early BCG. The results for the two BCG arms were therefore combined in the analysis of the effect of supplementation.

The overall mortality rate ratio (MRR) for neonatal vitamin A supplementation versus placebo assessed up to 12 months was 1.08 (95% confidence interval 0.79 to 1.47), but a significant interaction with sex was seen. The MRR was 0.74 (0.45 to 1.22) in boys and 1.42 (0.94 to 2.15) in girls. These results were similar to the previous trial in Guinea-Bissau in normal birthweight babies.[7] The authors now present a combined analysis which yields the following MRRs: overall 1.08 (0.87 to 1.33), boys 0.80 (0.58 to 1.10), and girls 1.41 (1.04 to 1.90), with a significant interaction (P<0.01) between neonatal vitamin A supplementation and sex.

The post hoc combination of two trials in the absence of a formal systematic review and meta-analysis is normally discouraged and must always be interpreted with caution. However, these two trials showed remarkable homogeneity, and they independently showed a tendency towards a harmful effect of vitamin A at birth that seemed to be confined to girls. In this case a combined analysis can be defended on the grounds that the two trials represent complementary arms covering the full birthweight spectrum within the same urban population of Guinea-Bissau, and, most importantly, the latest trial was called for by international experts who predicted a beneficial effect.

The authors have a reputation for challenging dogma in relation to vaccine and micronutrient supplementation policies. Through retrospective analysis of numerous datasets (their own and those of others) they have shown repeated examples of how vaccines, micronutrients, and exposure to infections can strongly affect all cause mortality in regions with a high burden of infection. In relation to the present context, Benn and colleagues have previously reported that vitamin A and DTP (possibly all killed vaccines) can have malign effects in girls that may be potentiated when the two are combined.[8 9] Sceptics have argued that their evidence has been based on "unintended experiments," and that the trends are often non-significant in isolation. The emergence of supporting evidence from prospective randomised controlled trials now cannot be ignored.

Sex differential effects, presumably relating to immune modulation, are certainly plausible. Sex differences in susceptibility to certain infections and in responses to vaccination have been recognised for decades.

Where do we go from here? With the support of the Bill and Melinda Gates Foundation, WHO has commissioned three large trials in an attempt to resolve the possibility that neonatal vitamin A supplementation may be beneficial in Asia but not in Africa. As commissioned, these trials are only required to assess mortality up to six months of age. Benn and colleagues rightly argue that failure to monitor mortality until 12 months would be a costly missed opportunity and may be dangerously misleading. If, as hypothesised, the potentially negative effects of early vitamin A supplementation in girls are potentiated by DTP, then a longer follow-up is essential. In Benn and colleagues' combined analysis, the detrimental effect of neonatal vitamin A supplementation in girls had a MRR of 1.21 from birth to three months but 1.70 (1.08 to 2.67) between four and 12 months.[1] Although the new trials are not individually powered to assess sex differential effects, they could help to resolve this controversy once and for all.

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Medical implications of the Taser

Serious harm is rare, but incident reporting needs to be improved

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Several tactical options are available to police officers facing potentially aggressive or violent people or those with acute behavioural disturbance. The less lethal options include restraint, batons, incapacitant sprays, impact rounds, and conducted energy devices such as Tasers. Although none is risk free, Tasers have attracted particular controversy, with Amnesty International identifying more than 300 deaths associated with their use in the United States.[1] However, association is not causation, and other factors complicate the interpretation of fatal outcomes.

The dominant conducted energy device used in police forces worldwide is the Taser X26. This device generates five second trains of electrical pulses that are delivered to the body either by two propelled barbs (which embed in clothing or skin and remain connected to the handset by conductive wire) or by direct contact of the handset's electrodes (drive-stun mode).[2] In the United Kingdom, propelled barbs are used by police in 90% of incidents in which such a device is discharged.[3] Anecdotal evidence indicates that the threat of discharge alone may be an effective deterrent.[3]

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In drive-stun mode, the principal action of the discharge is to induce pain (designed to gain the subject's compliance). When the barbs are propelled, greater electrode separation facilitates the induction of involuntary (and painful) contraction of skeletal muscle mediated by stimulation of sensorimotor nerves.[2]

The medical consequences of these discharges include barb injuries, localised discharge burns, and injury from falls or from the intense muscle contraction.[2] Eye and brain injuries from barb penetration have been documented.[2 4] Tonic-clonic seizure after discharge of a conducted energy device to the head has been described.[5] Pneumothorax after pleural barb penetration has been reported.[6] Six fatal head injuries may have resulted from falls induced by these devices.[2] Discharge of a conducted energy device does not induce clinically relevant changes in heart rate, blood pressure, or respiratory related parameters in healthy subjects.[7]

Whether the current from one of these devices can directly affect the heart is controversial. Atrial fibrillation in an apparently previously healthy child has been associated with exposure to discharge.[8] Although induction of ventricular fibrillation is considered improbable,[2] the safety margin for precipitating ectopic beats may be smaller because of a lower threshold for their initiation by an extrinsic electrical stimulus.[9] Limited data in volunteers subjected to barb application of device discharge across the upper right to lower left anterior chest found no evidence for cardiac capture.[10] However, no human studies have investigated discharge applied directly over the heart. In a review of outcomes after use of a Taser against 1201 people in the US, two deaths were noted, neither of which was attributed to the device.[11] This implies that the risk of induction of ventricular fibrillation, if one exists, is low.

The device is likely to be used on people who are physiologically and emotionally stressed, factors that may predispose to an increased risk in susceptible individuals (for example, those intoxicated with drugs or those who have cardiovascular disease).

The term excited delirium has been used to describe the bizarre behaviour, often related to the use of cocaine, exhibited by many of those who have died after use of a conducted energy device.[1] However, excited delirium is not unique to the use of these devices and is associated with deaths after use of other forms of force by the police.[12]

The medical assessment of people subjected to discharge from a Taser must be guided, in part, by the range of potential outcomes described above. The assessment must include full past and current medical history, medication use, drug and psychiatric history. Electrocardiography may be indicated, particularly where intoxication with drugs, alcohol, or volatile substances exists or where subjects have cardiac disease or dysrhythmias. Pregnant women should be referred for obstetric review.

A history should be sought from police officers present when the device was deployed, so that the examination can be tailored to evaluate injuries at sites of barb penetration or contact with the stun electrodes, and at other sites where injury may have been sustained (such as the head, spine, or eyes). Acute shortness of breath associated with barb penetration of the chest should be evaluated by radiography.

Barbs may be removed by application of firm in-line traction, unless they are embedded in regions at risk of potential serious injury (such as eyes and the skull), in which case specialist intervention should be sought. Further investigation is unlikely to be needed if the subject is stable and has no illness, condition, or injury beyond the superficial lesions caused by the barbs or stun electrodes.

The UK government has established a standing committee of independent clinicians which provides evidence based information to advise ministers on the medical implications of less lethal weapons used by the police and the army. The committee has advised on technologies such as water cannons, impact rounds, and Taser, and their opinion feeds into user training, deployment policy, and post-incident medical management. Unless dealing with technologies that have sensitive national security implications, the committee's advice is accessible publicly (for example, www.westmercia.police.uk/assets/_files/documents/sep_09/wmp__1252486507_ACPO_Policy_and_Operational_Us.pdf).

The UK Scientific Advisory Committee on the Medical Implications of Less-Lethal Weapons (SACMILL) monitors operational use, medical reports, and media reports for emerging problems. When necessary, the committee will recommend changes to operational use or training to minimise the risk of adverse medical outcomes.

Reports in the medical literature of serious injuries associated with the deployment of Tasers are few, despite several hundred thousand estimated uses of the device.[2] Lesser injuries may be under-reported. It is crucial, therefore, that governments and law enforcement organisations, assisted by healthcare professionals, establish mechanisms to improve understanding of the medical consequences surrounding the use of conducted energy devices such as Tasers and other less lethal technologies. The systematic capture of medically relevant data from operational incidents is a vital step in this process.

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