TABLE II—INTERNAL CONTAMINATION OF HIGH-SPEED HANDPIECES WITH BACTERIOPHAGE ϕX174*

—	Handpieces	
	1–4	5–9
Inside handpiece	$8{\cdot}1\ (6{\cdot}5) \times 10^5$	$5{\cdot}8\ (2{\cdot}2) \times 10^6$
Exhaust air	$1{\cdot}0\ (0{\cdot}6) \times 10^5$	$1{\cdot}4\ (1{\cdot}0) \times 10^6$
Water	$4{\cdot}7\ (3{\cdot}9) \times 10^2$	$6{\cdot}7\ (3{\cdot}9) \times 10^3$
Drive air	$4{\cdot}0\ (2{\cdot}5) \times 10^5$	$2{\cdot}3\ (1{\cdot}3) \times 10^3$
Chip air	$8{\cdot}3\ (6{\cdot}5) \times 10^3$	$4{\cdot}5\ (3{\cdot}9) \times 10^3$

*Data = mean (standard error) expressed as viruses/ml buffer solution used to flush handpieces exposed to a suspension of 5 and 20×10^8 viruses/ml for handpiece groups 1–4 and 5–9, respectively. The separate handpiece groups were connected to different dental units and were towel-wiped before sampling

DNA was detected inside each handpiece, in all but one of the attached exhaust hoses, and in all but one of the combined samples from drive air, chip air, and water hoses.

Live bacteriophage contamination was present in variable amounts with all handpieces and involved both external and internal surfaces (see table II for representative data). With some handpieces, there was as much contamination internally as externally. Internal contamination of the connecting hoses was also observed in all bacteriophage experiments. Contamination was seen predominantly in the exhaust lines and to a lesser extent in the air and water input lines. Exhaust-line contamination levels were the same or slightly lower than levels of internal handpiece contamination. Contamination ranging from 10^4 to 10^6 viruses/ml (0·001–0·1% of viral suspension to which devices were exposed) was expelled from handpieces after surface-disinfecting the devices and operating them to collect contamination air/water spray. Low concentrations of bacteriophage (< 10/ml) were also ejected from sterilised handpieces attached to contaminated hoses.

Discussion

Our results, from laboratory and clinical studies, show that high-speed dental handpieces and prophylaxis angles take up and expel patient materials and so can potentially transfer infectious agents from one patient to another. Discharge of both patient material and viable bacteriophage particles from dental equipment is worrisome, mainly because the material was present in internal areas of the equipment that are not readily accessible to chemical germicides. Moreover, germicide solutions are generally applied only to the outside of the equipment (by wiping or wrapping), especially with high-speed, air-turbine handpieces. In addition, water-repellant lubricants used inside the equipment coat internal mechanisms and can prevent contact of contaminants with disinfectant solutions. Patient cross-contamination with blood (and possibly bits of tissue) from inadequately disinfected internal mechanisms therefore represents a clear, if unquantified, risk of infection. This risk of transmitting blood-borne pathogens will be greatest when procedures involving blood (eg, crown preparations, sectioning teeth, and prophylaxis) are done closely together between infected and uninfected patients. Other pathogens normally passed via saliva and sputum may also be transmitted by this mechanism.

We conclude that reused high-speed, air-driven handpieces and prophy angles should be cleaned and heat-treated between each patient to kill microbes in internal areas of the devices. Additional studies on hose contamination and on ways to eliminate such possible risks should be carried out. These risks include contamination hazards from material passed directly into patients' mouths from reused equipment as well as exposures via exhausts that leave the dental units in the operating area and contaminate the surrounding environment.

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SHORT REPORTS

Cardiotoxicity after accidental herb-induced aconite poisoning

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Aconitine and its related alkaloids are known cardiotoxins with no therapeutic role in modern western medicine. The rootstocks of *Aconitum* plants, which contain aconite alkaloids, have been common components of Chinese herbal recipes. We have documented life-threatening intoxication in 17 Chinese subjects after accidental herb-induced aconite poisoning. All patients developed symptoms of aconite toxicity within 2 h of herb ingestion. Most developed tachyarrhythmias, including ventricular tachycardia and fibrillation from which 2 patients died. Toxicological evaluation revealed that aconites from the *Aconitum* rootstocks were the only plausible casual factor for intoxication. These cases point to the need for strict surveillance of herbal substances with low safety margins.

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Herbal medicinal preparations have undergone centuries of empirical experimentation and have been thought to be generally safe, although exceptions are known—eg, foxglove

leaves (digoxin), datura flowers (atropine), and podophyllum roots (podophyllotoxin).[1] We have studied the intoxication that took place in otherwise healthy individuals after ingestion of herbal decoctions containing aconite alkaloids. Such incidents are largely avoidable and highlight the need for strict surveillance of herbal practices.

During a three-year interval from 1989 to 1991 17 cases of accidental herb-induced aconite intoxication were managed in five public hospitals in Hong Kong. Hospital records were reviewed in detail. Of 15 patients discharged alive, 13 were contacted and underwent detailed history-taking, physical examination, routine blood sampling, 24 h ambulatory electrocardiography, and echocardiography. Routine toxicological screening for commonly encountered western medications was done for each patient on admission. Details of the herbal prescription, source of purchase of herbs, and method of preparation of the decoction were obtained. Residual amounts of the herb and the decoction were retrieved. Herb samples from four cases and an authentic herbal decoction in one case were analysed for aconite alkaloids (aconitine, mesaconitine, and hypaconitine) by high-performance liquid chromatography.

We studied 12 men and 5 women, all ethnic Chinese, with a median age of 56 years (range 9–81). 1 patient had had a myocardial infarction; the remaining 16 had no organic heart disease. No patient had a history of tachyarrhythmia. Before intoxication, each patient had ingested a decoction prepared from a compound herbal prescription that included the "cured" (processed) rootstocks of *Aconitum carmichaeli, A kusnezoffii,* and/or *A brachypodum.* The herbs were taken for rheumatism in 11 patients, respiratory tract infection in 4, as a "tonic" in 1, and for prostatism in 1. No patient was taking any western medication at the time of herb ingestion. In no patient was the intoxication intentional.

Symptoms of intoxication—dizziness, nausea, vomiting, numbness, and palpitations—began at a median of 30 min (range 3 min to 2 h) after herb ingestion. Patients were admitted at a median of 4 h (1·5–11) after herb intake. All patients except 2 were hypotensive; in 6, blood pressure was unrecordable. Tachyarrhythmias were the main therapeutic challenge in most patients. 2 patients had ventricular fibrillation on admission; 13 had ventricular tachycardia that was mainly sustained (9) and polymorphic (9). 2 patients had frequent polymorphic ventricular ectopics. 9 subjects had a raised serum creatine kinase with no electrocardiographic evidence of acute myocardial infarction; 4 had hypokalaemia, 4 metabolic and/or respiratory acidosis, 2 respiratory alkalosis, 3 renal and 1 hepatic impairment, and 1 aspiration pneumonia.

All patients were managed on our intensive care unit. Gastric lavage was done as necessary and 2 patients received intragastric activated charcoal. 11 patients required high-dose inotropic support, 8 were mechanically ventilated, and 7 required cardiopulmonary resuscitation. No single antiarrhythmic agent was uniformly effective for arrhythmia control. A median of 2 (range 1–4) antiarrhythmic drugs had been given unsuccessfully to 11 patients, including lignocaine in all, amiodarone in 5, and bretylium in 3. Repeated direct-current cardioversions were unsuccessful in 10 patients. Suppression of ventricular tachycardia was eventually achieved in 9 patients with amiodarone (5), flecainide (2) procainamide (1), or mexiletine (1). In 6 patients, non-sustained ventricular arrhythmias subsided spontaneously.

2 patients died from refractory ventricular fibrillation within 6 h of admission. The remaining 15 patients were stabilised within 24 h and subsequently discharged. After a median of 15 months follow-up, all 13 patients were symptom-free; ambulatory electrocardiography did not reveal any clinically important arrhythmias and echocardiography was normal.

Toxicological screening for western medications that are commonly taken in overdose was negative in all cases. Prescriptions comprised a median of 13 (5–34) herbs. Apart from aconites, no other herb has been reported to be arrhythmogenic, although some—eg, hooks of *Uncaria* and roots of *Angelica pubescens*—do have hypotensive actions.[2] The prescribed amounts of the cured *Aconitum* rootstocks ranged from 3 g to 20 g. Inspection of the herb samples revealed suboptimum curing of the rootstocks in two cases. Non-adherence to recommended methods of preparation of the decoction (most commonly a shorter duration of boiling) was identified in 3 cases. 7 patients had previously consumed decoctions prepared from the same prescription without adverse sequelae. In 3 the decoction that resulted in intoxication was prepared differently, and in the other four the *Aconitum* rootstocks were purchased from a different herbstore. Chromatography confirmed the presence of aconitine, mesaconitine, and hypaconitine in all herb specimens analysed.

Our report is the largest series of aconite intoxication reported in the English-speaking literature.[3,6] The notable features were the severity of intoxication, the life-threatening nature of the cardiac arrhythmias, and the critical haemodynamic states on presentation all of which affected otherwise healthy individuals who took herbs for minor complaints.

Aconites are the dried rootstocks of *Aconitum* (subgenus *Aconitum*) plants.[2,7] These plants contain the C_{19}-diterpenoid-ester alkaloids (including aconitine, mesaconitine, and hypaconitine) and other substances that have biological activity. Aconites have long been taken for medicinal purposes in the East and West.[7,8] Indications have included rheumatism, neuralgia, and cardiac complaints.[2,9] Toxicity of aconites has also been recognised.[2,9]

In Chinese medicine *Aconitum* rootstocks are processed by soaking or boiling them in water, which leads to hydrolysis of the aconite alkaloids into less toxic derivatives such as aconines.[2] The decoction is prepared by boiling the herb mixtures in water for a specified time. The recommended dose of the cured *Aconitum* rootstock has been 8 g–12 g, but this value has been lowered progressively to 1·5–3 g after reports of toxicity.[9] The prescription and sale of *Aconitum* rootstocks are subject to legal surveillance in China and Taiwan but not in Hong Kong. *Aconitum* rootstocks can be freely purchased from Chinese herbstores in western countries.

Aconite alkaloids activate the sodium channel and have widespread effects on the excitable membranes of cardiac, neural, and muscle tissues. Severe poisoning has been reported after ingestion of as little as 0·2 mg aconitine, or consumption of decoctions prepared from prescriptions containing 6 g of cured *Aconitum* rootstocks. Characteristic symptoms of intoxication include nausea, vomiting, and generalised paraesthesiae due to parasympathetic activation and sensory nerve ending stimulation. Muscarinic activation also causes hypotension and bradyarrhythmias.[2] Enhancement of a transmembrane inward sodium current during the plateau phase of the action potential prolongs repolarisation in cardiac myocytes and induces afterdepolarisations with triggered automaticity.[10] This event underlies the ventricular tachyarrhythmias seen in our patients.

The management of aconite intoxication poses a serious therapeutic challenge. No antidote is available, and clinical experience remains limited. Amiodarone and flecainide are reasonable first-line anti-arrhythmic drugs. Cardioversion and antitachycardia pacing are unlikely to be effective. Cardiopulmonary bypass might provide the last resort for circulatory support in refractory ventricular fibrillation.[5] Intragastric activated charcoal might be beneficial to reduce aconite absorption. Extracorporeal techniques are unlikely to be effective or feasible in enhancing aconite elimination given the lipid-solubility and the molecular size of aconite (645·7 kDa).

With current herbal practice, several factors might easily predispose to accidental aconite poisoning. For example, prescription of herbs by unqualified herbalists with the possibility of erroneous dosing; unsatisfactory curing of *Aconitum* rootstocks; and non-adherance to recommended methods of decoction preparation. Health policy-making authorities, the professional community, and the public should be alerted to the risk of herbal substances with low margins of safety. Strict legal surveillance should be imposed on the registration, processing, and prescription of such materials.

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Amphotericin versus pentamidine in antimony-unresponsive kala-azar

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We compared the efficacy of amphotericin B and pentamidine isethionate in a prospective randomised trial in 120 uncomplicated and parasitologically confirmed cases of antimony-unresponsive kala-azar. Doses were twenty intramuscular injections of pentamidine 4 mg/kg on alternate days or fourteen definitive doses of amphotericin 0·5 mg/kg infused in 5% dextrose on alternate days. 48 (80%) patients given pentamidine showed initial cure and 46 (77%) showed definitive cure compared with 60 (100%) and 59 (98%) cases, respectively, on amphotericin ($p < 0·001$). Amphotericin also brought about quicker abatement of fever and more complete spleen regression.

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The antifungal agent amphotericin B is effective against leishmania too[1-3] but at the doses used for systemic mycoses it is toxic, the toxicity being dose-dependent.[4] We postulated that it should be easier to get rid of a parasite than a saprophyte infecting an already immunocompromised host, and in a small series we showed that that was so.[5] We now report our experience with a larger series comparing the efficacy of amphotericin B with pentamidine, the other drug commonly used in the treatment of antimony-unresponsive kala-azar.

We recruited 120 patients who had not responded to or had relapsed after a course of sodium stibogluconate and randomly allocated them to pentamidine isethionate (P) or amphotericin B (A) (table I). We included only those cases which yielded the amastigote form of leishmania in a bone marrow smear (Leishman's stain). Patients with diabetes mellitus or with cardiac, renal, pulmonary, or hepatic complications were excluded. The patients and physicians were aware of the treatment given but the technicians and pathologists were not. Since the criteria for cure were purely objective, bias is unlikely to have affected the results.

Patients gave informed consent. The importance of follow-up was explained to each patient. Almost all patients lived within 100 km of Darbhanga. The trial was conducted between October, 1990, and December, 1991. The protocol was approved by the Drug Controller of India.

The pentamidine isethionate treatment was twenty intramuscular injections of 4 mg/kg on alternate days. For

TABLE I—BASELINE CHARACTERISTICS

—	P (n=60)	A (n=60)
M/F	48/12	47/13
Age (yr)	26·5 (9·2)	24·3 (10·9)
Weight (kg)	37·3 (8·8)	35·4 (3 2)
Duration of illness (mo)	5·9 (2·8)	6·6 (3·0)
Leucocyte count (× 10^9/l)	3·4 (1·2)	3·2 (1·2)
Platelet count (× 10^9/l)	109·4 (63·7)	109 6 (59 6)
Haemoglobin (g/dl)	8·9 (1·3)	9·1 (1·3)
Blood urea (mmol/l)	3·5 (1·0)	3·3 (1·1)
Blood glucose (mmol/l)	4·2 (0·4)	4·1 (0·4)
Liver enlargement (cm)	3·5 (1·9)	3·8 (2·3)
Spleen enlargement (cm)	8·8 (3·8)	9·5 (3·4)

Values as mean (SD) unless otherwise indicated