Interim advice for clinicians managing patients with suspected polychlorinated biphenyl (PCB) poisoning

Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are environmentally persistent, man-made, chlorinated organic chemicals synthesised between the 1930s and 1970s for a range of applications, including: adhesives, copy paper, dyes, electronic components, hydraulic systems, insulation, paints and plastics. Their use in production has been illegal in the UK since 1987.

Two hundred and nine theoretically possible PCB congeners exist, the toxicity of the majority of which are not well-described. Twelve PCBs have similar biological activity at the aryl hydrocarbon receptor to dioxins and dioxin-like compounds. Dioxins are chemically distinct from PCBs, however, assessments of the potential toxicity of PCBs are often inferred from 2,3,7,8-tetrachlorodibenzene-pardioxin (TCDD), the most potent of the dioxin compounds.

Exposure

Polychlorinated biphenyls are present in the environment as mixtures of PCB congeners. These compounds are odourless and tasteless. In liquid form they are oily and yellow. Some are volatile and present in the air. Human exposure may occur from ingestion of contaminated food or water, inhalation, and direct skin contact. Polychlorinated biphenyls can cross the placenta and are present in breast milk; so are potential sources of exposure to the foetus and the nursing child, respectively.

Toxicokinetics

The absorption of PCBs varies, depending on the site of exposure and the lipophilicity of individual compounds. Dermal absorption is less effective than oral; absorption by inhalation has not been quantified in humans. Orally, 50-100% of PCBs are absorbed and predominantly enter the lymphatic system, avoiding significant first-pass metabolism.

Polychlorinated biphenyls are transported in the plasma lipoprotein fraction and distribute throughout the body. The majority of PCBs are distributed to adipose tissues, liver, and skin.

Polychlorinated biphenyls are substrates for the cytochrome P450 enzymes and a range of metabolites and secondary metabolites conjugates are described in humans. Theoretically, genetic polymorphisms and drug-PCB interactions could be expected to alter concentrations or metabolite structure, however, the clinical relevance of this is unknown.

Elimination of PCBs occurs through the faeces and, for conjugated metabolites, through the kidneys. The elimination of the majority of PCBs has not been formally calculated. Estimates of half-lives vary between 0.02 years and over 20 years.

Clinical management

There is no clinical pathway that has been demonstrated to provide safe and effective treatment of patients with suspected PCB poisoning and no antidote exists. Management aims to minimise exposure and treat critical effects. The following advice is based on recognised critical effects of PCBs and the principles of good medical practice. These include:

1. Exploration of the patient's concerns and expectations ;
2. History of exposure, including occupational or amateur contact with PCBs and dioxins;
3. Identification and management, if appropriate, of critical effects of PCBs;
4. Patient empowerment through knowledge exchange.

Critical effects

Epidemiological studies of occupational groups or general populations have identified associations between PCBs or dioxins, typically TCDD, and several health effects in humans. None of the critical effects are unique to PCB toxicity. The strengths of the associations and the effect-size of any associated increased risk vary considerably, with many inconclusive studies.

1. **Cancers**: The International Agency for Research on Cancer (IARC, 2015) classified the dioxin-like PCBs as *carcinogenic to humans* (Group 1), specifically noting a causal relationship for malignant melanoma. Positive associations were also observed for breast cancer and non-Hodgkin lymphoma (NHL). Suspected cancers should be managed through existing clinical pathways. Screening for breast cancer should be through existing pathways. There is insufficient evidence to support population screening for malignant melanoma or NHL. Clinical management should focus on symptom awareness and investigation of suspected cases through existing clinical pathways.

2. **Cardiovascular risk**: PCB exposure is associated with an increased incidence of cardiovascular disease or cardiovascular risk factors, specifically hypertension, hyperglycaemia and abnormal lipid profiles, in some populations. Suspected patients should be screened for cardiovascular symptoms and comprehensive risk factor assessment undertaken.

3. **Dermal:** Chloracne, inflamed dioxin-like PCB laden sebaceous glands, is characteristic of exposure to dioxin-like compounds. The absence of this feature does not, however, exclude the possibility of PCB poisoning. There is no specific treatment, although a dermatological opinion may be required to

exclude an alternative diagnosis. An increased incidence of abnormal pigmentation and eczema has been associated with increased PCB exposure in some populations. These conditions should be managed through existing clinical pathways.

4. **Thyroid:** Abnormal thyroid function and the incidence of goitre has been associated with increased PCB exposure in some populations. Assessment should include screening for symptoms and signs of thyroid disease and a thyroid function test. Abnormalities should be managed through existing clinical pathways.

5. **Abnormal liver enzymes:** Assessment should include screening for symptoms and signs of liver disease and a liver function test. The usual differential diagnoses should be considered. Abnormalities should be managed through existing clinical pathways.

6. **Haematological:** Assessment should include a FBC. The usual differential diagnoses should be considered. Abnormalities should be managed through existing clinical pathways.

7. **Immunological:** Atopic symptoms, including an increased incidence of wheezing by the age of 7, have been associated with increased PCB exposure. Cases should be managed through existing clinical pathways. Reduced responses to some vaccines have been associated with increased PCB exposure, however, the effect of this observation on clinically relevant outcomes is uncertain. No specific management is currently recommended.

8. **Reproductive:** Increased PCB exposures are associated with several reproductive or developmental effects, including reduced semen quality, cryptorchidism, differential puberal development and low birth weights. These should be managed through existing clinical pathways, including sub-fertility pathways and usual antenatal screening.

PCB concentrations in biological samples

Exposure is not synonymous with toxicity. There is insufficient knowledge of exposure-concentration-effect relationships to interpret the result in individuals and there is insufficient evidence that biomonitoring can improve health. A validated measure of PCBs in biological samples is not available through the NHS.

Further advice

The UK National Poisons Information Service provides further advice on suspected poisoning through TOXBASE® at https://www.toxbase.org.

Authorship

Welsh National Poisons Unit

All Wales Therapeutics & Toxicology Centre

University Hospital, Llandough

References

Agency for Toxic Substances and Disease Registry. Toxicological profile for polychlorinated biphenyls (PCBs). U.S Department of Health and Human Services. 2000. Accessed 25 September 2026 at https://hero.epa.gov/reference/197065/

Agency for Toxic Substances and Disease Registry. *ATSDR Clinician brief: PCBs*. U.S Department of Health and Human Services. July 2026. Accessed 25 September 2026 at https://www.atsdr.cdc.gov/environmental-medicine/hcp/clinician-briefs/pcbs.html

Duarte-Davidson R, Jones KC. *Polychlorinated biphenyls (PCBs) in the UK population: estimated intake, exposure and body burden*. Science of the total environment. 1994 Jul 11;151(2):131-52.

EFSA Panel on Contaminants in the Food Chain (CONTAM). *Risk for animal and human health related to the presence of dioxins and dioxin-like PCBs in feed and food*. EFSA Journal. 2018 Nov;16(11):e05333.

International Agency for Cancer Research. *Polychlorinated biphenyls and polybrominated biphenyls*. 2015;107. Accessed on 25 September 2026 at https://publications.iarc.who.int/131.

World Health Organization. *Preventing Disease through Healthy Environments Exposure to Dioxins and Dioxin-like Substances: A Major Public Health Concern*. 2010. Accessed 2 October 2026 at https://iris.who.int/server/api/core/bitstreams/f329da06-d2d3-486b-98ff-94936e7c026b/content.