CVD Risks Tied to Teeny-Tiny Plastics Lodged in Atherosclerotic Plaque

— And the prevalence of microplastics and nanoplastics is only increasing



It was common for tiny plastic particles from the environment to infiltrate people's vascular lesions, foreshadowing future cardiovascular disease in patients who underwent carotid endarterectomy, an observational study showed.

An increased risk of combined myocardial infarction, stroke, or death from any cause over nearly 3 years was observed in people who had microplastics and nanoplastics detected in atherosclerotic plaque from surgically excised carotid plaque specimens (20.0% vs 7.5%, HR 4.53, 95% CI 2.00-10.27).

Out of 11 types of plastics assessed, two in particular were detected in the atheroma: polyethylene in 58.4% of participants (at a mean concentration of 21.7 μg/mg plaque) and polyvinyl chloride in 12.1% (mean 5.2 μg/mg), reported researchers led by Raffaele Marfella, MD, PhD, of University of Campania Luigi Vanvitelli in Naples, Italy.

"Polyethylene and polyvinyl chloride, in their various forms, are used in a wide range of applications, including the production of food and cosmetics containers and water pipes. MNPs [microplastics and nanoplastics] have been found in drinking water, a large range of foods, cosmetic products, and air, also in a form bound to fine, inhalable particulate matter ... Given the wide distribution and availability of MNPs, the attribution of all potential sources in humans is nearly impossible," the authors wrote in the [*New England Journal of Medicine*](https://www.nejm.org/doi/full/10.1056/NEJMoa2309822).

Indeed, the investigators noted that they could not determine why some people showed these small plastic particles in their carotid plaque and not others.

Around the world, the environment is increasingly inundated with plastic due to industrial processes. Plastics break down into smaller microplastics (particles smaller than 5 mm) and nanoplastics (particles smaller than 1,000 nm), both of which enter the human body through ingestion, inhalation, and skin exposure and have been found in the placenta, lungs, liver, and other tissue, according to Marfella's group.

The CDC says [bisphenol A](https://www.cdc.gov/biomonitoring/BisphenolA_FactSheet.html) (BPA), a plastic used to make beverage containers and toys, for example, appears to be widespread in urine among Americans. BPA was shown to affect reproductive systems of laboratory animals.

There has not been much evidence beyond preclinical experiments to show the harms of all this plastic, however.

And so, the annual output of approximately 400 million tons is expected to double by 2040 and triple by 2060, as fossil fuel producers pivot from selling energy to producing plastic, according to Philip Landrigan, MD, of Boston College and Centre Scientifique de Monaco, writing in an [accompanying editorialo](https://www.nejm.org/doi/full/10.1056/NEJMe2400683). "Until now, information on the health effects in humans of ingested or inhaled microplastics and nanoplastics [has been scant](https://www.medpagetoday.com/publichealthpolicy/environmentalhealth/98540)," Landrigan wrote. "Although there is much we still do not know about the hazards to health and the environment posed by plastics, the information now available is cause for concern. Current patterns of production, use, and disposal are not sustainable."

COVID-19 alone resulted in [over 8 million tons of mismanaged plastic waste](https://www.medpagetoday.com/publichealthpolicy/environmentalhealth/95557) around the world as of August 2021. Landrigan highlighted the United Nation's commitment to develop a Global Plastics Treaty and urged healthcare professionals to "express our strong support" for it. "We need to argue for inclusion in the treaty of a mandatory global cap on plastic production, with targets and timetables, restrictions on single-use plastics, and comprehensive regulation of plastic chemicals."

As for clinical practice, he suggested encouraging patients to reduce their use of plastics and finding ways to reduce the institutional [use of plastics](https://www.medpagetoday.com/popmedicine/popmedicine/106760).

"Like solutions to climate change, resolution of the problems associated with plastics will require a wide-scale transition away from fossil carbon. The path will not be easy, but inaction is no longer an option," the editorialist emphasized.

The present prospective study was conducted at Hospital Cardarelli, Ospedale del Mare, and the University of Salerno in Italy. Included were 304 consecutive patients undergoing carotid endarterectomy for asymptomatic high-grade (>70%) carotid artery disease, of whom 257 completed follow-up averaging 33.7 months.

Carotid plaque specimens had plastics detected using pyrolysis-gas chromatography-mass spectrometry, stable isotope analysis, and electron microscopy. Jagged-edged foreign particles, some containing chlorine, were confirmed among plaque macrophages based on scans from ten randomly selected patients who tested positive for both polyethylene and polyvinyl chloride.

Marfella's group reported that a greater concentration of polyethylene correlated with greater expression of inflammatory biomarkers and markers of lymphocyte and macrophage infiltration.

However, study authors cautioned that the plastics group tended to be younger, more likely men and smokers, and had a greater prevalence of diabetes, cardiovascular disease, and dyslipidemia.

The observational nature of the study meant that it was potentially subject to other residual confounding, precluding any causal conclusions. There was also a possible risk of laboratory contamination.