

# A Heart Made of Plastic: Plastic Exposure as a Risk Factor for Coronary and Carotid Artery Disease

Abdelrahman Abdelaal<sup>1</sup>, MBBCh, Mohamed Saltah<sup>2</sup>, MBBCh

1. Oxford University Hospitals NHS Foundation Trust, UK
2. Nasser Institute Hospital for Research and Treatment, Egypt

## Aim and objectives:

The main aim of this review is to:

- Determine the impact of plastic exposure, particularly micro or nano plastics (MNPs) on the occurrence of coronary and carotid artery disease.
- Investigate the main pathological cause of such effect and whether other chemicals or contaminants can also be responsible.

## Methods:

Literature research was done on PubMed, Web of Science, Cochrane, and Scopus through March 2024. The following terms were used: “plastics” or “microplastics” or “MNP” and “carotid arteries” or “coronary vascular disease” or “cardiovascular” or “cardiotoxicity” as either keywords or MeSH terms.

Studies were then reviewed for their relevance and non-relevant ones were excluded.

Included studies and reviews were those which

- 1) investigated the relationship between exposure to plastics both in domestic and industrial settings and the occurrence of carotid or coronary artery disease.
- 2) Discussed both molecular and clinical implications of microplastics exposure or exposure to other chemical substances associated with plastic manufacturing.
- 3) published in English.

## Result:

Microplastics were found by Hu et al (2020) to be a major cause of oxidative stress. This has been found to be related to the size, type, surface, and structure. Oxidative stress results in endothelial damage which is a major step in atheroma formation. Tadic et al (2018) found that the accumulation of MNPs led to the occurrence of both tachyarrhythmia and bradyarrhythmia as a result of myocardial toxicity.

Bisphenol A (BPA), which is a chemical used in the manufacturing of polycarbonate plastics, was found by Fang et al (2014) to be associated with the progression of atherosclerotic plaques and hypertension. It was also found to alter myocardial contractility by acting on multiple receptors including beta-adrenergic and estrogen receptors. Interestingly, Bhagat et al (2021) found that other contaminants such as fungicides and metal ions, which are usually associated with MNP, were found to cause combined myocardial toxicity. In the most recent study conducted by Marfella et al (2024) with 257 patients, 150 patients (58.4%) had polyethylene in their carotid artery plaques (mean level:  $21.7 \pm 24.5$   $\mu\text{g}/\text{mg}$ ). Additionally, 31 patients (12.1%) had polyvinyl chloride (mean level:  $5.2 \pm 2.4$   $\mu\text{g}/\text{mg}$ ). Patients with carotid artery plaque in which MNPs were detected had a higher risk of a composite of myocardial infarction, stroke, or death from any cause at 34 months of follow-up than those in whom MNPs were not detected.

## Conclusion:

There is significant evidence linking plastic exposure to both carotid and coronary artery disease as well as cardiotoxicity. More research into larger human cohorts is needed to help guide environmental policies and clinical management decisions.

## Keywords:

Microplastics, MNP, carotid arteries, coronary vascular disease, cardiotoxicity