Chapter 8

Drugs in Bone and Bone Marrow

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Summary

Bone and bone marrow are specimens recently investigated as a matrix for drug testing. Following extraction by soaking bone in organic solvent, routine drug assays may be utilized to measure compounds. Antidepressants, benzodiazepines, and illicit drugs such as cocaine have been reported in bone.

Key Words: Drugs, bone, bone marrow, skeletonized remains, teeth, analysis.

1. INTRODUCTION

Bone and bone marrow have received relatively little attention compared to other alternative specimens. This is most likely due to the restriction of obtaining this specimen in post-mortem cases. Nevertheless, a number of case reports and studies have been conducted that clearly show that drugs are present in both bone and bone marrow. The presence of drugs in reported cases have aided the investigation into these deaths that was not possible given the often skeletonized state of the remains.

This chapter reviews the current state of knowledge both in terms of the drugs detected in these specimens and how drugs are recovered from these most unusual matrices.

2. PHYSIOLOGY AND STRUCTURE

Bone marrow is a vascular tissue that is present in the central cavities of bones. Marrow is most easily obtained from the major bones, ribs, and
vertebrae. There are two types of marrow: red and yellow. Red marrow supports clusters of hemapoietic cells, white blood cells, macrophages, and has a rich blood supply. Yellow marrow supports numerous blood vessels and fat cells.

Bone is a highly vascularized tissue consisting of porous mineralized structure consisting of hydroxyapatite. The structure and composition varies according to the location. Cortical bones have a low turn-over rate and represents about 80% of the overall skeletal mass and provide the strength of the skeleton. Trabecular or cancellous bone is less dense, is spongy, and has a higher turn-over rate and largely consists of epiphyseal and metaphyseal parts of long bones and within smaller bones.

The degree of contact of drugs to the bone structures depends on the anatomical location of the bone and the local blood supply. The long bones (i.e., femur) receive the most blood supply while the short, flat, or irregular bones receive more superficial supply through the periosteum. Bone is not a uniform structure. For example, bone consists of layers or bundles of bone. Bone contains channels that contain small blood vessels and nerves (haversian canals).

3. Treatment of Bone and Bone Marrow for Analysis

Marrow when collected as a fluid can be diluted with water or a buffer, the mixture macerated, and drugs extracted with a solvent in a very similar manner to other fluid specimens (1). Bone marrow has a high fat content that may cause some difficulties, but this may be overcome by treating the dried solvent extract with hexane/ethanol (7:2) (e.g., 5 mL) and a small volume of water (0.2 mL). The hexane layer is discarded and the drugs isolated from the ethanol fraction (Table 1) (2).

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