
11 Regional Variation in Percutaneous Absorption

Principles and Applications to Human Risk Assessment

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CONTENTS

| | |
|---|-----|
| 11.1 Introduction | 165 |
| 11.2 Regional Variation in Humans | 165 |
| 11.3 Regional Variation in Animals..... | 169 |
| 11.4 Applications to Human Risk Assessment..... | 170 |
| 11.5 Conclusion | 171 |
| References..... | 172 |

11.1 INTRODUCTION

The first occupational disease in recorded history was scrotal cancer in chimney sweepers (1). The historical picture of a male worker holding a sweeper and covered from head to toe with black soot is vivid. But why the scrotum?

Percutaneous absorption in man and animals varies depending on the area of the body on which the chemical resides. This is called regional variation. When a certain skin area is exposed, any effect of the chemical will be determined by how much is absorbed through the skin. Where systemic drug delivery is desired, such as transdermal delivery, a high-absorbing area may be desirable to deliver sufficient drug. Scopolamine transdermal systems are supposedly placed in the postauricular area (behind the ear) because at this skin site the percutaneous absorption of scopolamine is sufficiently enhanced to deliver effective quantities of the drug. A third example is with estimating human health hazard effects of environmental contaminants. This could be pesticide residue on exposed parts of the skin (head, face, neck, and hands) and trying to determine the amount of pesticide that might be absorbed into the body. The estimate for skin absorption is an integral part of the estimate for potential hazard; thus, accuracy of estimate is very relevant.

Therefore, when considering skin absorption in humans, the site of application is important. Principles are reviewed and examples of applications to human risk assessment are given. Human risk assessment assigns a number to skin absorption and multiplies by skin area involved. This should include human anatomy and clothing worn.

11.2 REGIONAL VARIATION IN HUMANS

Feldmann and Maibach (2) were the first to systematically explore the potential for regional variation in percutaneous absorption. The first absorption studies were done with the ventral forearm because this site is convenient to use. However, skin exposure to chemicals exists over the entire body. They first showed regional variation with the absorption of hydrocortisone (Figure 11.1).