

# Errors in Radiology

Luigia Romano  
Antonio Pinto  
*Editors*



Springer

R445  
R 759

Luigia Romano • Antonio Pinto  
Editors

# Errors in Radiology

南京市鼓楼  
图书馆藏



X008835

X008835



Springer

*Editors*

**Luigia Romano**

Department of Diagnostic  
Radiological Imaging  
“A. Cardarelli” Hospital  
Naples, Italy

**Antonio Pinto**

Department of Diagnostic  
Radiological Imaging  
“A. Cardarelli” Hospital  
Naples, Italy

ISBN 978-88-470-2338-3

e-ISBN 978-88-470-2339-0

DOI 10.1007/978-88-470-2339-0

Springer Milan Dordrecht Heidelberg London New York

Library of Congress Control Number: 2012936593

© Springer-Verlag Italia 2012

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

5 4 3 2 1

2012 2013 2014 2015

Cover design: Ikona S.r.l., Milan, Italy

Typesetting: Graphostudio, Milan, Italy

Printing and binding: Esperia S.r.l., Lavis (TN), Italy

*Printed in Italy*

Springer-Verlag Italia S.r.l. – Via Decembrio 28 – I-20137 Milan

Springer is a part of Springer Science+Business Media ([www.springer.com](http://www.springer.com))

---

## Preface

Errors in medicine have become headline news in recent years, and legal action against physicians for alleged malpractice is an increasing problem in all industrialized countries and in all specialties. Radiology has not been immune to these events. Moreover, many of its unique aspects make radiologists particularly vulnerable, due to the inherent characteristics of the discipline and its latest developments, which together call for careful assessment of the images produced by increasingly sophisticated imaging modalities.

Mistakes are unavoidable. As health-care professionals, we must admit that they can happen, but, once discovered, make sure they are not repeated. The study of errors provides the necessary foundation for radiologists to apply professional standards and exercise personal ability, as well as responsibility, to improve the quality of their own work and that of their department.

Diagnostic errors fall into recurrent patterns. Error traps need to be uncovered and highlighted in order to prevent repetition of the same mistakes.

The purpose of this book is to discuss and illustrate many of the errors occurring in radiology practice. The 28 chapters cover a large spectrum of diagnostic errors and present a wide series of cases related to diagnostic errors involving plain film, ultrasonography, computed tomography, magnetic resonance, and angiography studies. In addition, medico-legal issues related to Interventional Radiology, radiology reporting, child abuse, foreign bodies, body-packing, and contrast medium administration are addressed.

A culture of safety must be developed within radiology departments such that whenever we come across an error made by a colleague, we bring that error to his or her attention in a sensitive and constructive manner. At the same time, it is essential that radiologists and radiology departments continue to improve the process of recording and addressing errors.

The expertise, breadth of knowledge, and thoroughness conveyed by the authors of this volume provide a valuable source of information on the spec-

trum of potential errors in radiology. We hope that this book will allow radiologists to reduce the rate of errors in their work and to improve the quality of their departments.

April 2012

Luigia Romano  
Antonio Pinto

---

## Contributors

**Ciro Acampora**, Department of Diagnostic Radiological Imaging,  
“A. Cardarelli” Hospital, Naples, Italy

**Manal Azzouz**, Department of Diagnostic Radiology, Copenhagen  
University Hospital, Herlev, Denmark

**Domenico Barbuti**, Department of Radiology, “Bambin Gesù” Children’s  
Hospital, Rome, Italy

**Antonio Barile**, Department of Radiology, “San Salvatore” Hospital,  
University of L’Aquila, L’Aquila, Italy

**Emilio Bassi**, Institute of Radiology, Foundation IRCCS “San Matteo”  
University Hospital, Pavia, Italy

**Franco Bocchini**, Department of Diagnostic Imaging, “Pineta Grande”  
Medical Center, Castelvolturmo (CE), Italy

**Adriana Bonifacino**, Breast Unit, “Sant’Andrea” Hospital, Sapienza University  
of Rome, Rome, Italy

**Luca Brunese**, Department of Health Science, Chair of Radiology,  
University of Molise, Campobasso, Italy

**Vitaliano Buffa**, Department of Cardiovascular Radiology,  
“San Camillo-Forlanini” Hospital, Rome, Italy

**Elisa Buzzi Rizzi**, Department of Radiology, National Institute for Infectious  
Diseases IRCSS “L. Spallanzani”, Rome, Italy

**Corrado Caiazzo**, Breast Screening Unit “Corso Vittorio Emanuele”,  
ASL Napoli 1 Centro, Naples, Italy

**Stefano Canestrini**, Department of Radiology, “G.B. Rossi” University Hospital, Verona, Italy

**Ferdinando Caranci**, Department of Diagnostic Imaging and Radiotherapy, Neuroradiology Unit, “Federico II” University, Naples, Italy

**Onofrio Catalano**, Department of Radiology, Massachussetts General Hospital, Harvard Medical School, Boston, MA, USA

**Carlo Cavaliere**, Department of Diagnostic Radiological Imaging, MR Body Unit, “A. Cardarelli” Hospital, Naples, Italy

**Roberta Cianci**, Department of Neurosciences and Imaging, Section of Radiological Imaging, “G. d’Annunzio” University, Chieti, Italy

**Teresa Cinque**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Marco Cirillo**, Department of Radiology, “Bambin Gesù” Children’s Hospital, Rome, Italy

**Armando Conchiglia**, Department of Radiology, “San Salvatore” Hospital, University of L’Aquila, L’Aquila, Italy

**Laura Conti**, Department of Radiology, “San Salvatore” Hospital, University of L’Aquila, L’Aquila, Italy

**Antonio R. Cotroneo**, Department of Neurosciences and Imaging, Section of Radiological Imaging, “G. d’Annunzio” University, Chieti, Italy

**Roberta Cotti**, Radiology Unit, “Regina Margherita” Children’s Hospital, Turin, Italy

**Massimo Cristofaro**, Department of Radiology, National Institute for Infectious Diseases IRCSS “L. Spallanzani”, Rome, Italy

**Federico D’Orazio**, Department of Radiology, “San Salvatore” Hospital, University of L’Aquila, L’Aquila, Italy

**Stefania Daniele**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Carlo Nicola De Cecco**, Department of Radiological, Oncological and Pathological Sciences, Sapienza University of Rome – Polo Pontino, Latina, Italy

**Giuseppe De Magistris**, Department of Diagnostic Radiological Imaging, Vascular and Interventional Radiology Unit, “A. Cardarelli” Hospital, Naples, Italy

**Rosaria De Ritis**, Department of Diagnostic Radiological Imaging, MR Body Unit, “A. Cardarelli” Hospital, Naples, Italy

**Claudio Defilippi**, Radiology Unit, “Regina Margherita” Children’s Hospital, Turin, Italy

**Giovanni Di Leo**, Department of Medical and Surgical Sciences, University of Milan; Radiology Unit, “San Donato” Hospital IRCCS, San Donato Milanese (MI), Italy

**Roberto Dore**, Institute of Radiology, Foundation IRCCS “San Matteo” University Hospital, Pavia, Italy

**Roberto Farina**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Antonella Filippone**, Department of Neurosciences and Imaging, Section of Radiological Imaging, “G. d’Annunzio” University, Chieti, Italy

**Anna Frezza**, Surgery Unit, “Villa delle Querce” Clinic, Naples, Italy

**Nicola Gagliardi**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Michele Galluzzo**, Department of Emergency Radiology, “San Camillo” Hospital, Rome, Italy

**Gianluigi Guarnieri**, Department of Diagnostic Radiological Imaging, Neuroradiology Service, “A. Cardarelli” Hospital, Naples, Italy

**Franco Guida**, Department of Diagnostic Imaging, “Pineta Grande” Medical Center, Castelvoturno (CE), Italy

**Isabella Iadevito**, Department of Diagnostic Radiological Imaging, MR Body Unit, “A. Cardarelli” Hospital, Naples, Italy

**Roberto Izzo**, Department of Diagnostic Radiological Imaging, Neuroradiology Service, “A. Cardarelli” Hospital, Naples, Italy

**Giuseppe Lanni**, Department of Radiology, “San Salvatore” Hospital, University of L’Aquila, L’Aquila, Italy

**Franco Maglione**, Department of Diagnostic Radiological Imaging, Vascular and Interventional Radiology Unit, “A. Cardarelli” Hospital, Naples, Italy

**Fabio Martino**, Department of Radiology, ASL BARI, Mola di Bari (BA), Italy

**Gianluigi Martino**, Faculty of Medicine, University of Bari, Bari, Italy

**Carlo Masciocchi**, Department of Radiology, “San Salvatore” Hospital, University of L’Aquila, L’Aquila, Italy

**Vittorio Miele**, Department of Emergency Radiology, “San Camillo” Hospital, Rome, Italy

**Mario Muto**, Department of Diagnostic Radiological Imaging, Neuroradiology Service, “A. Cardarelli” Hospital”, Naples, Italy

**Carlo Muzj**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Yousef W. Nielsen**, Department of Diagnostic Radiology, Copenhagen University Hospital, Herlev, Denmark

**Raffaella Niola**, Department of Diagnostic Radiological Imaging, Vascular and Interventional Radiology Unit, “A. Cardarelli” Hospital, Naples, Italy

**Pasquale Paolantonio**, Department of Radiology, “San Giovanni – Addolorata” Hospital, Rome, Italy

**Nicoletta Pignatelli di Spinazzola**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Antonio Pinto**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Fabio Pinto**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Gianluca Ponticiello**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Roberto Pozzi Mucelli**, Department of Radiology, “G.B. Rossi” University Hospital, Verona, Italy

**Alfonso Ragozzino**, Department of Radiology, “Santa Maria delle Grazie” Hospital – ASL Napoli 2 Nord, Pozzuoli (NA), Italy

**Alfonso Reginelli**, Department of Internal and Experimental Medicine “Magrassi-Lanzara”, Section of Radiology, Second University of Naples, Naples, Italy

**Luigia Romano**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Stefania Romano**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Giovanna Russo**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Francesco Sardanelli**, Department of Medical and Surgical Sciences, University of Milan; Radiology Unit, “San Donato” Hospital IRCCS, San Donato Milanese (MI), Italy

**Mariano Scaglione**, Department of Diagnostic Imaging, “Pineta Grande” Medical Center, Castelvoturno (CE), Italy

**Stefano Schininà**, Department of Radiology, National Institute for Infectious Diseases IRCSS “L. Spallanzani”, Rome, Italy

**Maria Giuseppina Scuderi**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Giacomo Sica**, Department of Diagnostic Imaging, “Pineta Grande” Medical Center, Castelvoturno (CE), Italy

**Amelia Sparano**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Ciro Stavolo**, Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital, Naples, Italy

**Henrich S. Thomsen**, Department of Diagnostic Sciences, Faculty of Health Sciences, University of Copenhagen, Copenhagen, Denmark

**Margherita Trinci**, Department of Emergency Radiology, “San Camillo” Hospital, Rome, Italy

**Adele Valentini**, Institute of Radiology, Foundation IRCCS “San Matteo” University Hospital, Pavia, Italy

---

# Contents

<b>1</b>	<b>Errors in Radiology: Definition and Classification</b> .....	<b>1</b>
	Antonio Pinto, Maria Giuseppina Scuderi, and Stefania Daniele	
<b>2</b>	<b>Malpractice Claims in Mammography</b> .....	<b>9</b>
	Adriana Bonifacino and Corrado Caiazzo	
<b>3</b>	<b>Errors in the Diagnosis of Lung Neoplasms</b> .....	<b>19</b>
	Luigia Romano, Antonio Pinto, and Carlo Muzj	
<b>4</b>	<b>Errors in Polytrauma</b> .....	<b>27</b>
	Franco Guida, Giorgio Bocchini, Giacomo Sica, Anna Frezza, and Mariano Scaglione	
<b>5</b>	<b>Missed Fractures in the Emergency Department</b> .....	<b>39</b>
	Vittorio Miele, Michele Galluzzo, and Margherita Trinci	
<b>6</b>	<b>Missed Fractures in Children</b> .....	<b>51</b>
	Fabio Martino, Domenico Barbuti, Gianluigi Martino, and Marco Cirillo	
<b>7</b>	<b>Plain Film or MDCT as a First Diagnostic Tool in Patients with Cervical Spine Injury: Critical Issues</b> .....	<b>65</b>
	Gianluigi Guarnieri, Roberto Izzo, and Mario Muto	
<b>8</b>	<b>Errors in Sonography</b> .....	<b>79</b>
	Roberto Farina and Amelia Sparano	
<b>9</b>	<b>Errors in Color Doppler Ultrasonography</b> .....	<b>87</b>
	Ciro Acampora, Fabio Pinto, and Giuseppe De Magistris	

<b>10</b>	<b>Errors in MDCT Angiography</b> .....	105
	Roberto Dore, Adele Valentini, and Emilio Bassi	
<b>11</b>	<b>Errors in MDCT Coronary Angiography</b> .....	119
	Vitaliano Buffa, Carlo Nicola De Cecco, and Vittorio Miele	
<b>12</b>	<b>Errors in the Diagnosis of Hepatic Neoplasms</b> .....	125
	Alfonso Ragozzino, Onofrio Catalano, and Pasquale Paolantonio	
<b>13</b>	<b>Pitfalls in Pancreatic Imaging</b> .....	139
	Roberto Pozzi Mucelli and Stefano Canestrini	
<b>14</b>	<b>Errors in the Interpretation of the Non-traumatic Acute Abdomen</b> ...	155
	Antonella Filippone, Roberta Cianci, and Antonio R. Cotroneo	
<b>15</b>	<b>Errors in the MDCT Diagnosis of Intestinal Ischemia and Infarction</b> .....	169
	Stefania Romano, Gianluca Ponticiello, and Giovanna Russo	
<b>16</b>	<b>Crohn's Disease: Errors of Interpretation in Emergency MDCT Evaluation</b> .....	177
	Luigia Romano, Maria Giuseppina Scuderi, and Stefania Daniele	
<b>17</b>	<b>Pitfalls of MRCP in the Evaluation of the Biliary Tract and Pancreatic Duct</b> .....	195
	Rosaria De Ritis, Isabella Iadevito, and Carlo Cavaliere	
<b>18</b>	<b>Errors in Musculoskeletal MRI</b> .....	209
	Carlo Masciocchi, Laura Conti, Federico D'Orazio, Armando Conchiglia, Giuseppe Lanni, and Antonio Barile	
<b>19</b>	<b>Errors and Medico-legal Issues in Interventional Radiology</b> .....	219
	Raffaella Niola, Giuseppe de Magistris, and Franco Maglione	
<b>20</b>	<b>Errors in Radiology Reporting</b> .....	227
	Fabio Pinto, Stefania Romano, and Ciro Acampora	
<b>21</b>	<b>Errors in Radiology: A Biostatistical Framework</b> .....	235
	Francesco Sardanelli and Giovanni Di Leo	
<b>22</b>	<b>Child Abuse: Imaging and Legal Aspects</b> .....	249
	Claudio Defilippi and Roberta Cotti	

---

<b>23</b>	<b>Retained Intra-abdominal Surgical Sponges: Critical Issues</b>	<b>263</b>
	Nicola Gagliardi, Nicoletta Pignatelli di Spinazzola, and Ciro Stavolo	
<b>24</b>	<b>Foreign Body Ingestion and Rectal Foreign Body Insertion: Diagnostic Challenges</b>	<b>271</b>
	Antonio Pinto, Amelia Sparano, and Teresa Cinque	
<b>25</b>	<b>Radiological and Medico-legal Problems of Body-packing</b>	<b>279</b>
	Antonio Pinto, Ciro Stavolo, and Carlo Muzj	
<b>26</b>	<b>Assessment of Risk in Radiology Using Malpractice RVUs</b>	<b>287</b>
	Massimo Cristofaro, Elisa Busi Rizzi, and Vincenzo Schininà	
<b>27</b>	<b>Contrast Media Administration: Safety Issues and Legal Aspects</b>	<b>293</b>
	Yousef W. Nielsen, Manal Azzouz, and Henrik S. Thomsen	
<b>28</b>	<b>Strategies To Reduce Errors in Radiology</b>	<b>303</b>
	Luca Brunese, Alfonso Reginelli, and Ferdinando Caranci	
	<b>Subject Index</b>	<b>309</b>

# Errors in Radiology: Definition and Classification

Antonio Pinto, Maria Giuseppina Scuderi, and Stefania Daniele

## 1.1 Introduction

As indicated by the title of the landmark report of the Institute of Medicine, “To Err is Human” mistakes are part of the human condition [1]. They cannot be prevented by trying harder. At best, systematic changes are needed to prevent physician’s from doing the wrong thing while making it more likely that they will do the right thing. This is accomplished by hardwiring functions into medical systems and providing information at the point of care [2].

There are four health-care-related factors contributing to medical errors that can lead to patient harm: (1) human fallibility, (2) complexity, (3) system deficiencies, and (4) a vulnerability of defensive barriers. All of these must be addressed to significantly improve patient safety [3].

Errors in medicine have become headline news in recent years, and legal action against physicians for alleged malpractice is an increasing problem in all industrialized countries and in all specialties.

Radiology is not immune to this phenomenon and presents a number of unique features linked to both the inherent characteristics of the discipline and its latest developments, which call for careful assessment [4].

Diagnostic radiology must aim for the complete detection of all abnormalities in an imaging examination and their accurate diagnosis [3].

It offers a presumptive rather than a histological or microbiological diagnosis and diverges from the normal path of other medical specialties, in that it depends entirely on visual perception and on the identification of specific characteristics on a radiograph. Mechanical, physiologic, and psychological factors contribute to an intricate diagnostic interplay that has yet to be fully

---

A. Pinto (✉)  
Department of Diagnostic Radiological Imaging, “A. Cardarelli” Hospital,  
Naples, Italy

appreciated [5]. Yet, it is clear that the technician and radiologist can perform their jobs in a more efficient and focused manner if physicians have provided adequate clinical information to the radiology department [5].

Diagnostic error in radiology is an important topic, with both medico-legal and quality control implications. To improve diagnostic accuracy, it is imperative to understand the nature and source of diagnostic errors. Traditionally, the study of radiological errors was limited to errors in radiologists' reports, often out of context of the whole diagnostic episode and omitting the integral role of referring physicians. Radiological investigation begins at the point of clinical suspicion of a condition, and ends with the receipt of the radiologist's opinion by the treating team. Radiologists become personally involved only after a request has been initiated and the desired images acquired, but these two stages also generate diagnostic errors that affect the episode's outcome.

Radiological problems that have led to medical malpractice lawsuits most frequently have been due to "failure to diagnose." The three main categories of claims are misdiagnoses, complications, and miscellaneous [6, 7]. Diagnostic errors often go unrecognized or unreported and may be associated with high patient morbidity. But malpractice lawsuits have adverse effects on a physician's health because physicians who have committed a severe error can experience an abrupt change in the quality of life and an increased frequency of burnout [8].

---

## 1.2 Definition of Error

The issue of patient safety plays a prominent role in health-care. Its prominence is fueled by an expanding body of literature that shows a high incidence of error in medicine [9-11] coupled with well-publicized medical error cases that have raised public concern about the safety of modern health-care delivery. Historically, patient safety researchers investigating the impact of medical error have adopted outcome-dependent definitions and surrogate terms, while limiting their focus to patients experiencing adverse outcomes or injury as a consequence of medical care [1-3]. Perhaps this tendency stems from the guiding principle of medical practice, credited to Hippocrates, *primum no nocere* ("First, do no harm") [12]. Moreover, the manner in which patient safety has been defined promotes an outcome-dependent approach to defining medical error.

In the 1990s, the publication of the three most extensive investigations on medical error – the Harvard Medical Practice Study [9, 10], the Quality in Australian Health Study [11, 13], and the Utah and Colorado Medical Practice Study [14] – gave prominence to the term "adverse event" defined as an unintended injury to patients caused by medical management (rather than the underlying condition of the patient) that results in measurable disability, prolonged hospitalization or both [9, 10, 14]. Alternatively, an adverse event can be considered as an unintended injury or complication that results in disability, death, or prolonged hospital stay and is caused (including acts of omission

and acts of commission) by health-care management rather than the patient's disease [11].

Definitions of medical error in the published literature include:

- The failure of a planned action to be completed as intended (an error of execution), or use of the wrong plan to achieve an aim (an error of planning) [15];
- An unintended act (either of omission or commission) or one that does not achieve its intended outcome [16];
- Deviations from the process of care, which may or may not cause harm to the patient [17].

But what is an error in radiology? An error is a deviation from the expected norm, regardless of whether it results in any harm. Errors may be categorized in a variety of ways and we have methods in place to facilitate their identification so that steps can be introduced to minimize their occurrence. In addition, medical errors can be further classified in terms of the outcome or harm suffered by the patient, if any, allowing assessment of the episode and the proper assignment of accountability [18].

In broad terms, factors contributing to errors are categorized as being system-related (latent errors) or person-related (active errors). The latter are human cognitive errors and are thus more likely to be preventable but also more likely to have an adverse outcome than technical errors. As applied to diagnostic radiology, three main categories of error are responsible for the majority of "missed" or misinterpreted observations on radiological examinations: technical (latent or system-related), active (errors in perception, knowledge, and/or judgment), or a combination thereof [18].

---

## 1.3 Classification of Errors in Radiology

In order for a radiologist or any other physician to be found liable for medical malpractice, four elements must be established. There must be a radiologist–patient relationship, the radiologist must have committed a negligent act (a breach of the standard of care), the negligent act must have caused injury to the plaintiff–patient (proximate cause), and the patient must have sustained an injury [19]. In general, there are four main reasons why radiologists are sued: (1) observer errors, (2) errors in interpretation, (3) failure to suggest the next appropriate procedure, and (4) failure to communicate in a timely and clinically appropriate manner [5].

### 1.3.1 Observer Errors

Kundel et al. [20] described the following types of observer error: scanning error, recognition error and decision-making error. The first results from failure of the radiologist to fixate on the area of the lesion.

Recognition error involves fixating on the territory of the lesion yet failing to detect the lesion, while decision-making error is the incorrect interpretation of a malignant lesion as a normal structure.

Another form of observer error that may contribute to lesions being overlooked is satisfaction of search (SOS) error [21]. An SOS error is the result of the radiologist's attention being diverted from a tumor by an eye-catching but unrelated finding. Another issue that may affect observer performance is intentional under-reading, that is, a conscious tendency to interpret equivocal radiographic shadows as negative [22]. This may occur because of collegial pressure to reduce the number of false-positive interpretations, and thereby decrease unnecessary work-ups.

Failures of abnormality detection in film reading (i.e. perceptual errors) are subject to psychophysiological factors of human visual perception [23]. They are common to visual perceptual tasks in general and are relevant to other professions (e.g. air traffic controllers, professional drivers) in which active observation is a key part of professional activity. Perceptual errors, in general, are likewise related to multiple psychophysiological factors, including level of observer alertness, observer fatigue, duration of the observation task, any distracting factors, and conspicuity of the abnormality, among many others [24]. An additional source of perceptual error results from the influence a radiology report has over another radiologist: this error occurs because the radiologist reads the first report before looking at the films [25, 26].

### 1.3.2 Errors in Interpretation

An error of interpretation, as its name implies, occurs at the interpretation phase of film reading and usually comprises an incorrect diagnosis given to an abnormal finding (or, rarely, to a normal finding). There are many reasons why radiologists make errors in identifying and interpreting abnormalities.

Poor ergonomics and ambient light, frequent telephone disturbances, working with an inexperienced resident, clinical history and other factors are various sources of error.

Errors of interpretation in diagnostic radiology are analogous to errors of interpretation in other branches of medicine. The closest similarity is to physical diagnosis, in which signs may be misinterpreted, an organ position is unrecognized, heart sounds are mistaken for one another, and so on. The principles of whether an error of interpretation can be considered negligence are the same in diagnostic radiology as in other branches of medicine. It is very important that errors of interpretation are judged against the standard of an average competent medical practitioner rather than against the unachievable standard of perfection.