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The emperor's clothes
Description of a new epidemic related to diagnostic imaging

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Abstract

In 1835, Hans Christian Andersen published "The Emperor's New Clothes", one of the 164 fairy tales that earned him worldwide fame. A little more than 25 years ago, drawing inspiration from that tale, F. Gross reported the existence of an ailment capable of affecting multiple systems, "the Emperor's clothes syndrome". This syndrome primarily affects students and physicians for whom career success is of paramount importance. Based on actual experience, we are describing a new epidemic of this ailment, for which the radiological image is the principal vector. We wish to draw attention to the danger of basing a diagnosis solely on diagnostic testing. In an age dominated by technology, we would like to emphasize that anamnesis and clinical examination are still the cornerstones of diagnosis. Any clinical or radiological information, any laboratory phenomenon is subject to variable interpretation by different observers. We also suggest that there are statistical methods for evaluating the reliability of a clinical test.

Key words : Diagnostic imaging ; Emperor's new clothes ; physical examination ; CT Scan ; NMR ; Interobserver Agreement.

It was in 1835 that Hans Christian Andersen published "The Emperor's New Clothes", one of the 164 fairy tales that earned him worldwide fame. In 1971, drawing inspiration from that tale, Frank Gross reported in the *New England Journal of Medicine*, the existence of a severe ailment capable of affecting multiple systems (1). He called it "the Emperor's clothes syndrome".

While the etiology and the pathogenesis of this ailment remain obscure, in that article, the author isolated various predisposing factors. The incidence is high among medical students and particularly among those for whom career is paramount. However, none of us is totally immune. The ailment often manifests itself during rounds and particularly in intensive care. While all systems may be affected, in his article, F. Gross discusses two clinical forms involving cardiology and neurology. The purpose of this paper is to report a new clinical form of this syndrome.

Description of a new epidemic

As neurosurgeons, we are regularly confronted with patients who are certain that they are suffering from diseases they do not have and who are convinced of their need for a life-saving operation. The lesions involved are frequently spinal, and particularly disk-related. The clinical expression is sometimes spectacular, especially when a secondary gain may be derived. We now believe that we have identified the vector of this epidemic and we implicate certain radiological images and their reports.

Allow me to tell you a tale, in turn : *Once upon a time, there was a physician who had the time to interview and examine his patients. He was not overwhelmed with administrative paperwork. His diagnosis was, above all, clinical and often correct. One day, he fell prey to the tyranny of radiological tests and, in particular, the CT scan and MRI. The "truth" was carved in the photographic image and translated into the report, even if it was in disagreement with the case history and the clinical symptomatology. We should note that this tyranny was regularly imposed on him by patients who often required that such and such a test be done, and by the specialists or consulting physicians, who could not take a position without surrounding themselves with multiple test reports, and even by the therapists themselves, who took numerous precautions against the possibility of litigation.*

Using two examples we have actually encountered, we would like to illustrate the danger of making a diagnosis based solely on diagnostic testing, and to recall the importance of listening and of clinical examination. We will start with the story of a false positive. A young trauma patient with a normal neurological profile was transferred to us by emergency helicopter for an extradural hematoma, surrounding and compressing the entire cervical portion of the spinal cord (Fig. 1). The radiologist who had been brought in to read the scan totally failed to grasp the fact that, a short time prior to the tomography, the patient has received an injection of contrast medium and that, consequently, only the epidural vascular plexus was visualized.

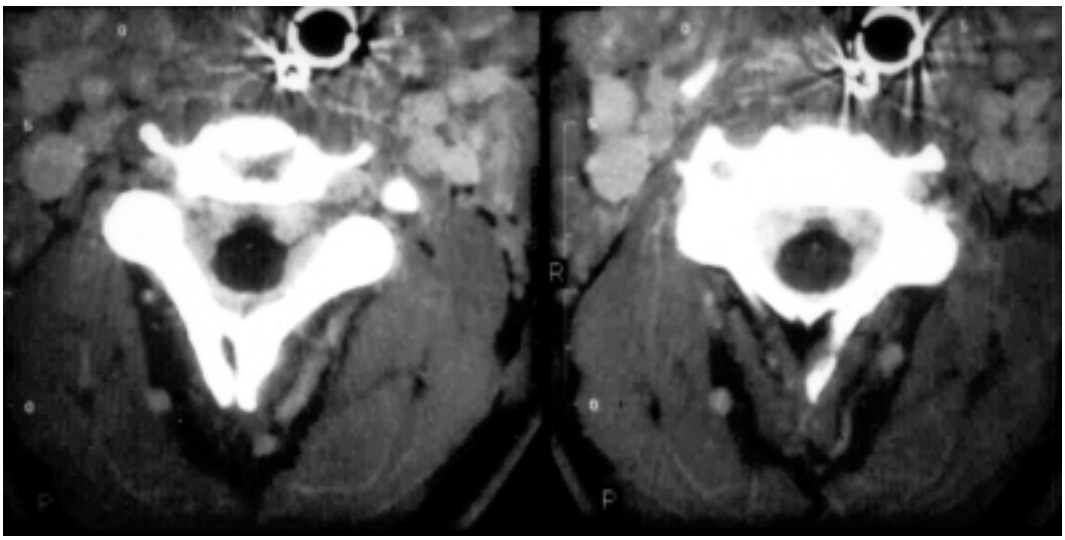

FIG. 1. — Two cross-sections of the cervical spine after injection of contrast medium by intravenous route. The cervical spinal cord (white arrows) is surrounded by a hyperdense ring representing the vascular plexus and not an extradural hematoma.

FIG. 2. — Brain CT scan of an infant with intracranial hypertension. This image shows a voluminous bilateral chronic subdural hematoma (1, 2) and not cerebral atrophy.

We would now like to describe a false negative. Much more dramatic is the story of an infant who, over a period of over several days, had been developing a picture of intracranial hypertension with vomiting, a bulging fontanelle and an increased head circumference. From the clinical perspective, everything pointed to a space-occupying lesional process. Unfortunately, the radiologist observed very extensive fluid spaces and reported "cerebral atrophy" (Fig. 2). It was not until several days later that the diagnosis of a chronic subdural hematoma was made by a pediatrician who was fortunate enough to have been trained before the age of the scan.

Discussion

The radiological image may be the source of numerous distortions and the subject of various manipulations.

According to M.C. Escher, drawing is deception (2). He said, in fact, that the artist suggests to us a three-dimensional world, while drawing paper is only two-dimensional. We have reason to wonder whether imaging is not also something of a deception.

Science, like any other social activity, is a field of ambitions and illusions. Scientific fraud and errors of interpretation emphasize the extent to which research may deviate from the ethical standards that are supposed to govern it. According to William Broad and Nicholas Wade, authors of "Betrayers of the Truth", the most famous case of collective scientific illusion was the discovery of "N" rays by the eminent French physician, René Blondlot (3). A professor at the University of Nancy, Blondlot was a renowned scientist, a laureate of the French Academy of Sciences. In 1903, while attempting to polarize X-rays, he discovered traces of a new radiation. It manifested itself in the increased luminance of an electrical spark. Other physicists were soon able to reproduce and expand upon Blondlot's results. One of his colleagues discovered that N rays were also emitted by the nervous system. N rays were observed by some forty persons and analysed in some 300 articles. However, we now know that N rays do not exist ! The scientists who had observed them were, to say the least, victims of their own illusion and suffering from the Emperor's clothes syndrome.

FIG. 3. — Cervical CT scan showing an image of a left lateralized herniated disk. Inspired by René Magritte, we would like to stress the difference between image and reality. We would encourage the practitioner to doubt and criticise the radiological diagnosis in view of the clinical data.

These examples, taken from the world of medicine, art and science, are witness to the fragility of the images and signs that we observe. However, there are statistical techniques that make it possible for us to evaluate the reliability of an observation (4). The interpretation of a test or a result must take into account a certain number of criteria that specify its symptomatologic contents and define its degree of usefulness within the diagnostic process. These include *Sensitivity*, which is the probability of obtaining a positive test in the disease population, and *Specificity*, which is the probability of obtaining a negative test in the healthy population. These two parameters often vary in opposite directions. We may also determine the positive or negative predictive value of a test. This parameter is particularly interesting for the clinician. In fact, this predictive value depends on the *Prevalence* of the disease in the tested population. The positive predictive value of a test is high when the disease is frequent and decreases dramatically when the percentage of individuals with the disease is low.

Furthermore, we should know that any clinical or radiological information is subject to variable interpretation by different observers and that is it possible, using statistical methods, to estimate the degree agreement between the various observers of the same document. The Kappa Index, defined in 1961 by Cohen, makes it possible to determine *Interobserver Agreement* (5). When this number is close to 1, this index signifies total agreement on the interpretation of the sign. We have used this statistical technique in the selection of brain stem reflexes which we included in the Glasgow-Liege Scale for evaluating the magnitude of dysfunction from traumatic brain injury (6). Unfortunately, today, the clinician is not accustomed to this critical statistical process.

Conclusions

We are obliged to declare that images can be deceptive. René Magritte painted a canvas depicting a pipe with the caption “This is not a pipe”. He entitled it “The Betrayal of Images” (1929). “Magritte thereby casts doubt on our ability to recognize the contents of an image and asks us to revise our judgment”, writes P. Comar (7). Likewise, when confronted with a CT scan or MRI, we should remember that the radiological picture is not the object itself, but an image showing a certain aspect of the object. Furthermore, the report is no more than a personal interpretation of that image. I’ve been imagining a CT scan suggestive of a herniated disk, captioned with the words “This is not a herniated disk” (Fig. 3). That annotation would induce us to cast doubt on our diagnosis.

A test report should never be considered a legally binding document. The confidence we may place in it depends on numerous parameters that are important to know. This particularly depends on the limitations of the technique used, the interobserver agreement concerning the interpretation of the signs and, of course, the qualifications of the specialist.

Consequently, the interpretation of a report requires training that the patient does not have. You can imagine the danger that the description of a herniated disk in a CT scan report would represent for a malingerer or a psychiatric patient who is not even suffering from any radicular pain. For the self-reporter, the image seen by the radiologist would be the focus of his entire attention and evidence of all his complaints while, in reality, an image of a herniated disk may be visualized in nearly 25% of all normal individuals.

The spectacular advances in medical imaging now make it possible to diagnose lesions that, in the past, most often went unnoticed. Today, we cannot help but marvel at the advantages of neuro-navigation, viz., image-guided surgery. Indeed, medical imaging is both angel and devil.

Since there must be a moral to every story, I will offer two thoughts. The first is that we should be treating patients and not radiological tests and the second is, in a world dominated on all levels by technology, we should not lose sight of the concepts of ethics, art and humanity.

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