



What Is a Complication? The Philosophical and Psychological Aspects

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Introduction

A 56-year-old female patient with a past medical history of hypertension and type II diabetes mellitus undergoes a diagnostic aneurysm at 1 year after coil embolization of an anterior communicating artery aneurysm. Fortunately, the aneurysm had been coiled prior to rupture, and the patient had not suffered any neurological deficits. Other than some difficulty in gaining access to the right common carotid artery, the angiogram went without any particular setback. In the post-procedure recovery unit, the patient complained of left arm weakness. Upon examination, the patient was unable to move her left arm, and it had no tone. She was rushed back to the angiography suite, where she was discovered to have a thrombus in a distal MCA branch, unable to be treated. MRI showed an MCA territory infarction. She was sent back to the recovery unit, where the attending physician explained the undesired outcome and the steps which would be taken to optimize her long-term outcome with hope of regaining some function in the left arm. Was this a medical error resulting in neurological deficit, or was this a complication of the procedure?

With the many advances in medicine comes the need to render the medical lexicon more precise and accurate. The environment in which modern medicine is practiced makes this need all the more important when discussing complications or adverse events. A complication is unplanned, uncommon, and unwanted. The difficulty lies in that defining a complication in general and defining a complication for a specific illness or procedure is a moving target. So many variables affect its characterization and its perception that it is difficult to develop a cohesive, standard

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definition for which all will agree. It is a definition that needs to resonate with patients, families, all health-care workers, clinician-scientists, and lawyers.

In its broadest sense, a complication is the result of unexpected events that result in an unwanted and uncommon outcome. Importantly, some of these events are directly the result of the disease process, genetics, or some other events that are beyond an individual's current control, whereas others can, indeed, be modified. Though this is instinctively obvious, historically there has been great difficulty in establishing a clear delineation between that which can and cannot be modified when discussing complications. This challenge has been the principal reason why there is a lack of consensus in the medical lexicon when discussing complications.

Historical Perspective

For as long as there has been the practice of medicine, there has been the potential for an unexpected, unwanted, and uncommon outcome. Mostly focused on surgical, or procedural, treatments, the concept of the complication was recognized since the days of Hammurabi, describing, for example, cutting the hand of the surgeon whose patient (of high status) would die after treatment (such as lancing a lesion) [1]. This concept of technical ineptitude as the only cause of a complication is carried through to the days of Hippocratic medicine in Greece. Adverse outcomes that could not be directly and concretely attached to an intervention were relegated to the whims of the supernatural and thus out of human control or blame.

Interestingly, though the Egyptian, Hippocratic, and Galenic writings demonstrated the fatalistic aspects of medical and surgical care, they also sowed the seeds of scientific inquiry. The numerous observations and subsequent care plans suggested "lessons learned" in the care of prior patients. With regard to the procedures themselves, it is clear that specific "instructions" on techniques for wound care, fracture management and splinting and, of course, trephining emanate from recognizing and modifying (more specifically, correcting) the missteps (hence, "complication management"). Most notably, as the physicians and surgeons began to discuss post-procedural care, discussion of complication management or avoidance required that the event be *recognized* as a complication in the first place. Galen's concept of laudable pus, for example, clearly a complication of any wound, was considered the normal course of healing (and thus not a complication). Indeed until the eighteenth century, carotid ligation with the use of a suture protruding from the skin *depended* on inflammation and infection to help definitively occlude the vessel. This observational docket of information, aligned with the birth of scientific anatomy and dissection, became the seeds of identifying the complication as we try to define it today [2].

There was some growth in our collective understanding of what physicians and surgeons could do to improve outcomes during the Renaissance. The focus of this improvement was fundamentally based on the surge in knowledge that came with human dissection combined with the beauty and accuracy that came with the rise of

Renaissance art. Thus, improved, accurate knowledge of human anatomy helped in reducing technical complications.

The greatest growth in the prevention of the complication occurred in the eighteenth and nineteenth centuries, and as expected, this growth focused on surgical procedures. Indeed, such growth paralleled the improved fund of knowledge in physiology and anatomy. Additionally, the introduction of anesthesia, the understanding of germ theory and infection, Listerian techniques, and the fundamental lessons of Florence Nightingale in the Crimean War are but a few of the many events that synergistically helped to improve complication avoidance, detection, and management. However, defining a complication remained elusive.

What Is a Complication?

Medical complications are difficult to define, making them challenging to differentiate from medical errors and at times leaving a medical outcome up to one's interpretation. The term "complication" has had a broad definition. As was discussed above, it reflected any event or outcome that was unwanted or unexpected, whether within or outside of the physician's control. More recently, *Collins Dictionary of Medicine* defines a complication as "an additional disorder, or new feature, arising in the course of, or as a result of a disease, injury, or abnormality" [3]. Again, the definition presented herein is broad and accounts for "natural" causes as well as iatrogenic causes. However, determining what is a complication in the course of treatment for a disease process from a medical error is of extreme importance. This distinction gains in amplitude when the outcome of complication or error significantly alters the long-term outcome of the patient. A more granular lexicon was necessary.

In 1991, Brennan et al. published an analysis in *The New England Journal of Medicine* investigating more than 30,000 records of hospitalized patients. They defined an *adverse event* as "an injury that was caused by medical management (rather than the underlying disease) and that prolonged the hospitalization, produced a disability at the time of discharge, or both," and *negligence* as "care that fell below the standard expected of physicians in their community" [4]. They estimated an adverse event rate of 3.7% and adverse events due to negligence to be 1% [4]. This landmark series of papers played a role in defining adverse outcomes due to physician negligence for medical malpractice. More recently, in 2016 Makary and Daniel published an analysis in the *BMJ* stating that medical error is the third leading cause of death in the USA, resulting in approximately 250,000 deaths per year [5]. This places death from medical error behind heart disease and cancer and ahead of respiratory disease as causes of death in the USA. Although the exact number of deaths from medical error is difficult to determine, the number itself is alarming when placed in the context of deaths due to other causes.

Medical complications and errors carry significant medical, ethical, and legal ramifications. In the scenario provided, stroke and neurological deficit are known complications when undergoing an angiogram. Nonetheless, one can always

wonder when the embolic event occurred, whether a different catheter could have been used, and whether the attending physician and fellow carefully studied the arch and vessels from the prior intervention to prepare for the anticipated difficult access. All these post-procedure complications can cloud the picture and change what was thought to have been a complication into a medical error, especially when there are legal ramifications involved.

Complications change with time and even technology. Hearing loss and facial palsy (partial or complete, temporary or permanent) after the resection of an acoustic neuroma of any size were common and expected though still unwanted. Today, hearing loss or, more importantly, facial palsy for an acoustic neuroma less than 1.5 cm in size is *neither* common *nor* expected as well as unwanted. Thus, it is now considered an *avoidable* adverse event. Sokol et al. emphasized this point by enhancing the definition, stating that a surgical complication (adverse event) is undesirable, unintended, and a *direct result* of surgery that, if it had gone well, would not have occurred [6].

What Is a Complication? The Philosophical Aspects

A medical complication is an undesired outcome which may not be under the control of the physician. Complications are results which were not desired but within the scope of potential outcomes. Medical errors and mistakes, in contrast, occur because of negligence or misguided action. For example, a complication would be a postoperative hematoma despite achieving hemostasis prior to closure. What if the hematoma occurred after the surgeon failed to practice proper hemostatic technique? Then the same outcome would constitute an error. As another example, an error (in this case, negligence) is closing a surgical wound with a foreign body remaining inside, consequently, having to take the patient back to the operating room to remove the foreign body. At times the line between complications is cut and dry, but it is often obscure.

Complications and adverse events often vary between different specialties. In general surgery, complications include surgical site infections despite the use of prophylactic antibiotics and sterile technique or the failure of an end-to-end bowel anastomosis. In many cases, the patient may require an increased length of stay, is subjected to the risk of intravenous antibiotics, or may undergo another operative intervention to relieve the risk. In obstetrics and gynecology, pregnancy and labor carry the risk of significant complications to both the mother and baby and can often result in the loss of both lives. In internal medicine or in the outpatient settings, patients with certain illnesses can deteriorate as a complication of their illness. Examples include acute respiratory failure after community-acquired pneumonia or an anaphylactic reaction to a medication which the patient was unknown to have an allergy resulting in a hospitalization. These complications vary in both scale and type, as some are part of a disease process and others resulting from an attempt at treatment.

As mentioned earlier, the line between complication and error is not always clear, and many times what one may believe is a complication may be seen by others as an error. For example, outcomes can range across the spectrum between a complication of the disease and gross negligence resulting in error. Referring back to the acoustic neuroma operation in the field of neurosurgery, for example, the outcomes of facial nerve deficit and hearing loss are possible following a craniotomy for resection of acoustic neuromas. Acoustic neuromas may vary in size, presentation, and radiographic features with some obviously being much larger than others. Patients who present with symptoms of headache, nausea, gait disturbance, hearing loss, and hydrocephalus secondary to the tumor may be more likely to accept an outcome resulting in unilateral hearing loss or mild facial nerve palsy than those who present without any symptoms. This does not mean that the hearing loss or facial nerve palsy is not a complication, but that the surgeon and patient may agree that the benefits of a complication such as hearing loss or facial palsy are acceptable over the life-long risks the tumor may carry.

A patient without many medical comorbidities who develops a postoperative myocardial infarction following a 5-hour elective surgery is a complication which was not under the direct control of the physician. This is true if the preoperative evaluation was complete, the surgery was indicated, and the length of surgery was reasonable. This event would be considered a complication as the event occurred despite all necessary steps taken to avoid it. In contrast, a post-interventional angiography procedure resulting in a groin hematoma or pseudoaneurysm due to improper technique for closure is a medical error because the error occurred as a consequence of poor technique.

In *Complications: A Surgeon's Notes on an Imperfect Science*, Atul Gawande discusses problematic encounters and outcomes which he learned from as he progressed through his residency training [7]. He writes, "The way that things go wrong in medicine is normally unseen and, consequently, often misunderstood. Mistakes do happen. We tend to think of them as aberrant. They are, however, anything but" [7]. While error is impossible to avoid in medicine, physicians of today, as our predecessors, must constantly work toward ways to decrease the rate.

As Gawande states, medical complications and errors will occur as long as humans continue to practice medicine. Physicians must continue to strive to achieve the best possible outcomes for each patient, doing no harm to the patient and staying true to the oath which they all promised to abide before entering medicine.

Psychological Aspects

Medical complications play a significant role at times in changing both the patient's and the doctor's lives. Physicians can struggle, at times, with the outcomes of their complication for their entire medical careers. In a 2010 study in *Surgery*, Patel et al. demonstrated the impacts complications have upon a surgeon [8]. Of the 123 surgeons who responded to the questionnaire for the study, 92 (76%) experienced their first complication during residency. The study promoted the idea that additional

support after residency should be in place for physicians to avoid burnout. Many times, physicians take the poor outcomes following a complication upon themselves. This can result in difficulties which the physician suffers in his/her personal life. In addition, it can result in decreased confidence, belief that one cannot adequately perform his/her job, and other alterations in practice. While complications change patients' lives, we must also remember the importance of constructively learning from the complication, studying the cause, and preventing it in the future.

Conclusion

All can agree that complications, adverse events, and medical errors are unwanted, rare, and unexpected. Defining each precisely is extremely important yet very difficult. In many ways, they are defined based on the surrounding environment and the need. The reader will appreciate that the scenario presented at the beginning of the chapter lacks a clear-cut answer; it can be debated as more details about the case are presented. Medical complications are inevitable. Adverse events will occur. Medical errors can happen. The goal of physicians should be to work toward developing a system in which the occurrences of these events are at a minimum. They should acknowledge the errors that are made, identify the causes, strive to understand them, take ownership of that which they can modify, and derive ways to avoid them in the future. Most important of all, the physician must never forget the complications in which he/she was involved, for in remembering them, the physician shall become stronger, safer, better for medicine, and better for the patients.

References

1. Roland J. Code of Hammurabi. Constitution Society; 2003. p. 1–48.
2. Chapmann A. History of complications. In: Hakim NS, Paplois VE, editors. Surgical complications: diagnosis and treatment. Imperial College Press: London; 2007. p. 1–40.
3. Youngson RM. Collins dictionary of medicine. 4th ed. Glasgow: Collins; 2005.
4. Brennan TA, Leape LL, Laird NM, Hebert L, Localio AR, Lawthers AG, et al. Incidence of adverse events and negligence in hospitalized patients. Results of the harvard medical practice study I. *N Engl J Med.* 1991;324:370–6.
5. Makary MA, Daniel M. Medical error—the third leading cause of death in the US. *BMJ.* 2016;353:i2139.
6. Sokol DK, Wilson J. What is a surgical complication? *World J Surg.* 2008. <https://doi.org/10.1007/s00268-008-9471-6>.
7. Gawande A. Complications: a surgeon's notes on an imperfect science. 1st ed. New York: Metropolitan Books/Henry Holt; 2002.
8. Patel AM, Ingalls NK, Mansour MA, Sherman S, Davis AT, Chung MH. Collateral damage: the effect of patient complications on the surgeon's psyche. *Surgery.* 2010;148:824–8.