

# Re-evaluating the Hierarchy of Evidence

## WHAT IS THE GOLD STANDARD?


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On October 16, 1846, William Morton took part in an operation to remove a tumour from a patient's neck. However, this surgery was unlike any other that had been completed before.<sup>1</sup> Morton's stage was the local surgical amphitheater in the Massachusetts General Hospital, and his main prop was the ether, a novel substance that promised to alleviate pain in an unprecedented manner. Within the amphitheater, scientists, dentists, and doctors eagerly awaited the awakening of Morton's patient after the surgery. To everyone's delight, after awakening, the patient announced that he did not feel any pain during the operation. Barely a month later, this local stage turned global when Henry Jacob Bigelow published this case study in the *Boston*

*Medical & Surgical Journal*.<sup>2,3</sup> To this date, the birth of anesthesia is considered a landmark medical discovery.

This story is remarkable for three main reasons. First, Morton wagered his time and reputation in order to investigate the use of ether as an anesthetic. Though the analgesic effects of ether had been previously known, it was used predominantly for entertainment purposes at the time, producing effects similar to alcohol, but with a faster onset.<sup>4</sup> Morton was the first to demonstrate that ether could be used within a medical setting.<sup>5</sup> Second, this public demonstration occurred on October 16<sup>th</sup>, 1846 and was published in the high-impact *Boston Medical and Surgical Journal* (the present-day *New England Journal of Medicine*) on November 18, a mere 33 days later.<sup>2</sup> The third and final reason is that Morton's bold investigation effectively launched the widespread use of anesthetics, which are now incorporated into virtually every area of modern medicine. Today, a story like this would seem more based on fiction rather than fact. In the contemporary and regulated research environment of the 21<sup>st</sup> century, would this remarkable story have been possible?

Since Morton's time, the conception of evidence-based medicine has significantly altered the landscape of medical research. Central to evidence-based medical research is the hierarchy of evidence, which ranks different study designs based on the strength of their methods.<sup>6</sup> The studies best protected against bias are ranked highest in the hierarchy. At the top of the hierarchy of evidence rest randomized control trials, which test enormous numbers of patients; at the bottom of the hierarchy rest case studies, as they typically focus on a physician's experience with a single patient. By acknowledging that medical research is prone to error, the hierarchy of evidence is crucial to the practice of evidence-based medicine. It enables fast and efficient identification of the

strongest evidence amongst a vast body of existing literature. Adoption of the hierarchy of evidence lends confidence to physicians and policy makers who use scientific evidence to direct decision-making.

It is clear that the modern research environment is tremendously different than that of Morton's time. Morton's case study would have been ranked lowest in the hierarchy of evidence; it would be a near miracle if it reached the pages of a high-impact journal within 33 days using today's standards. Often in medical research, controlled studies are deemed more "fit" for journals and academic discourse, while more audacious investigations, like Morton's case study, may be considered so anecdotal that they ought to be reserved for the diaries of deranged scientists.

A hierarchical system of evidence is valuable as it establishes a firm set of guidelines to follow when sifting through large quantities of information. However, there are some problems with this approach. Case studies are considered inherently biased in the hierarchy, as they are observational by nature. However, their merits lie in their lack of a controlled design, which offers an unfiltered and unique insight. They can spark new ideas and hypotheses or even launch a movement, as seen in Morton's case. By offering a different perspective from randomized control trials, studies with a higher risk of bias are still worthwhile endeavours for the unique insight they can provide.

Although science claims to be an objective endeavour, those who practice it are not free from biases. The "publish or perish" mentality describes the pressure on academic researchers to publish frequently in high-impact journals. Perhaps because case studies are considered a lower level of evidence, they are often less frequently cited in journals than other forms of evidence.<sup>7</sup> Consequently, journal editors may opt to avoid publishing these studies in favour of larger investigations that will garner citations and maximize their journal's purported influence.

## REVIEWED BY DR. MICHAEL WONG

Dr. Michael Wong (B.Sc., Ph.D.) is a professor at McMaster University in the Faculty of Health Sciences. His research involves applying a combination of physics, neurophysiology, and probability calculus to investigate tactile spatial acuity. The themes of his research include exploring the concept of enhanced tactile perception in the blind, and changes in tactile acuity during development and aging.



How does this practice impact the scientific community? As stated earlier, each level of the hierarchy of evidence has its own merits; yet certain forms of evidence are preferentially published in high-impact journals. Such published research can be easily circulated to the scientific community and receive more exposure than unpublished evidence. We argue that this is a misuse of the hierarchy. The hierarchy of evidence was originally intended to make us aware of the biases in studies, not to make us uncritically cast aside research based on its classification. Unfortunately, the pervasiveness of publication biases in the modern research environment dictates the types of studies we conduct, thus limiting the scope of the knowledge we choose to pursue.

Discoveries are often catalyzed by the work of observant scientists who pursue ideas that deviate from previous lines of work. The development of penicillin, like anesthesia, was largely based on a scientist's subtle observations.<sup>9</sup> Underscoring these discoveries are scientists with open minds who had opted for a less restrictive scientific process. However, this freedom in the scientific process is now somewhat lost by favouring certain research methodologies over others. This preference is not a direct result of the hierarchy of evidence's establishment or its goals, but rather a result of the manner with which the hierarchy is used by research journals when selecting studies for publication. The solution is not to dismantle the hierarchy altogether, but to ensure that we remain open to the different ways we can approach scientific research; otherwise, we run the risk of leaving fruitful avenues of knowledge unexplored. ■

FIGURE 1: The public demonstration of medical ether: On October 16, 1846, William T. G. Morton publicly demonstrated for the first time the use of ether as an anesthetic.<sup>8</sup>

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