In this issue of CJEM, Mater and colleagues evaluated the diagnostic test characteristics of plain radiographs in the form of a shunt series and CT scanning of the head to determine whether children have cerebrospinal shunt malfunction. These authors chose a clinical assessment as the reference standard, and specifically defined shunt malfunction.
malfunction as the decision of the neurosurgeon to perform a shunt revision. Given the absence of any other generally accepted reference standard, this definition was probably reasonable and is similar to that used in other recent studies.6,7 However, since the neurosurgeons undoubtedly used the results of the shunt series and CT scan of the head in their decision-making, this study is at risk for incorporation bias, one form of diagnostic test bias.8 This can occur when the diagnostic test under consideration is used to determine the reference standard, or the reference standard is used to determine the results of the diagnostic test. Incorporation bias is conceptually simple. For example, we’re much more likely to find signs of ischemia on an electrocardiogram after we discover an elevated troponin level. Similarly, radiologists are more likely to identify pulmonary infiltrates when the clinical information provided strongly suggests pneumonia.9

The main problem with incorporation bias is the overestimation of diagnostic accuracy.10,11 In other words, the proportion of correct results is expected to be higher than one would expect if incorporation bias was not present. This, of course, would lead to overall better test characteristics, such as sensitivity. Mater and colleagues have likely introduced incorporation bias into their study. Thus, as the authors rightly point out, they have probably overestimated the sensitivity of the shunt series and head CT scans in identifying children with shunt malfunction. Notably, the authors have concluded that the test characteristics of these radiographic studies are relatively poor. For their study, incorporation bias has little impact because it is likely that the test characteristics are even worse than the authors found in their study. Since the authors conclude that the tests are relatively “bad,” so to speak, it matters little that in reality the tests are even worse than they demonstrated. Unlike the study by Mater and colleagues, the situation in which incorporation bias really matters is when excellent test characteristics are found.

It is difficult to perform any research that is completely free of bias. As informed readers, it is important to understand various forms of bias that researchers may have introduced into their studies. It is equally important to understand how a particular form of bias may impact a study’s results. Mater and colleagues provide an excellent example of how bias can be inherent in a study design and yet have little impact on the results of the study. Just because a study is at risk for bias being present, doesn’t make the paper “bad” or “useless.” By understanding how a particular type of bias may impact a study’s results, readers can avoid being biased about bias.

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References


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