Editorial on Thoracic Surgery

Thoracic surgeons, mathematics, and statisticians: a new multidisciplinary team?

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Thoracic surgery is a field where the researchers, from data and techniques derived from more disciplines, are combined to solve problems where solutions are beyond the scope. Mathematical and physical science could play a significant role in thoracic surgery because sometimes issues could be resolved using mathematical techniques (1).

In their professional life, thoracic surgeons could use elementary mathematics as arithmetic (regarded as the most immediately useful parts of mathematics). A surgeon can count, performs elementary arithmetic, and even understands simple graphs and statistics. These core competencies and concepts are expected of every surgeon. As a graduate in medicine, the thoracic surgeon should have studied mathematics, usually included in physics and chemistry, biology, biochemistry, and perhaps even in anatomy. It is hard to make a case for more than simple mathematical techniques for the man in the street. There are obvious parallels with people who drive cars without understanding anything about the combustion engine or watch a tablet without understanding the electronic circuitry. Nevertheless, it is the rapid development of physics and chemistry, underpinned by mathematics, which has made medical advances possible: the development of the microscope; the discovery and use of radiation for diagnosis and therapy; the explosion of clinical laboratory investigations for diagnosis and prognosis (2).

Surgical research creates an even greater demand for mathematical literacy, among both scientists and the scientific press. Statistics could be a branch where math is simple to grasp because there is no need for a deep understanding of its fundamentals. Statistics can be taught as a little set of tools used to provide information about the significance of datasets. A surgeon can learn statistics without the concept of mathematical analysis. It is practical and not very sophisticated from a mathematical point of view. What a pity that, except some medical students, almost nobody is given any formal training (3,4). Therefore, it could be a study purporting to show that this technique is not right, and another study will purport to show exactly the opposite, and in many cases, the fuss is over small differences in risk on the border of statistical significance. When researchers use P values without really understanding what statistics beyond their data, the result often much ado about nothing (5). However, many colleagues use advanced statistical techniques (2,6-8).

Before we look at the interesting math may have for the surgeon, it is worthwhile to examine a little more carefully the process of applying mathematics to any practical problem of real life. Somehow, we should express our actual problem in such a way that mathematical techniques which are essentially abstract can be brought to bear. Surgeons are accustomed to the use of physical models in their work to illustrate various organs of the body, what they look like, and how they function and to study how to control them. A physical model is only a partial representation of the real thing. It will always be imperfect in some series; otherwise, it would be too complicated to be useful. A mathematical model, similarly, is a partial description or representation in mathematical terms of a real situation, but the building bricks, in this case, are the standard symbols of mathematics put together to form equations. These equations constitute the mathematical model, and the behaviour of quantities in the equations simulates the action of the corresponding physical entity in the real problem (2). In the past, some scientists proposed mathematical models in biological and medical problems. The first, from Leonardo of Pisa (1202, renamed as Fibonacci in the seventeenth century) was an exercise in his arithmetic book, the Liber Abaci (9). The problem is well known: to start with a male and female pair of young rabbits at the beginning of a breeding season, and, after one season, rabbits can reproduce and produce two pairs of young bunnies. The parents then stop building, but, after another season, the young rabbits produce two couples each and then stop; the progression continues exactly in the same way. The number of pairs of rabbits at each reproductive period is the famous Fibonacci series [1, 1, 2, 3, 5, 8, 13…], where each number is the sum of the previous two. The Fibonacci series arises in a surprisingly wide range of situations (10,11).

Mathematical biology has active researchers in all the biomedical sciences, and mathematical modelling (e.g., mathematical oncology) is another growth area for the future. A critical aspect of all this mathematical or theoretical biological research is its original interdisciplinary content. Mathematics could not solve major biological problems on its own. On the other hand, it is highly unlikely that even a reasonably complete understanding could come from experiment data (10). Therefore, at every surgeon's elbow is not only a nurse but a statistician. It is at postgraduate level, however, that the surgeon is most likely to find a need to extend his knowledge of mathematics (2). The surgeons could be then divided into two groups: those who consider statisticians utterly useless people (best left to work out of harm's way in their ivory towers), and those who regard statisticians as powerful. The place of mathematics and statistics in various professions has long been debated, and a current topic about which widely divergent views are held is that of computer-aided medical diagnosis. The truth is, of course, that there are some situations in which the mathematician or statistician can be of great assistance. Equally, there are many therapeutic areas for which no satisfactory mathematical or statistical techniques exist yet. The solution of problems often should wait for suitable advances in mathematics itself, just as developments in practical surgery can be held up till new practical skills or instruments become available. What seems to be most needed now is to extend the areas of collaboration between the professions of statistics and surgery. It could be necessary more statisticians aware of surgical problems and abled to try to build mathematical models of them. We need more surgeons, who know enough about statistics at least to be able to describe to a statistician potentially fruitful problems (2).

In conclusion, a multidisciplinary team approach, usual in the management of the lung cancer patient, could be used as a model in the cooperation between surgeons and data scientists.

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Footnote

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