chordae. The point is that the surgeon can begin with this formula, but must develop an appreciation for the nuances of valve repair and expertise with a variety of repair techniques to achieve good results. The surgeon must bring both a plan and the skill to execute it. McCarthy and colleagues³ provide a plan.

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Commentary: Repair of degenerative mitral regurgitation: Science, art, or both?

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Degenerative mitral valve regurgitation (MR) is the most common infirmity affecting the left atrioventricular valve and mitral valve repair (MVR) is now the indicated method of treatment (class I) with widely reported excellent and durable results. The principles and techniques of MVR are fairly well standardized, albeit with some controversy still surrounding the choice of preserve versus resect leaflet tissue, the use of artificial chordae, and type of ring/band for the annuloplasty. The aim is a perfectly competent valve with no residual prolapse ensured by adequate coaptation of the leaflet's free edge. Experienced surgeons should be able to repair the vast majority of these valves, irrespective of the extension of the disease, and capable of anticipating a good result before closing the left atrium supported by intraoperative transesophageal echocardiography before termination of cardiopulmonary bypass.¹

McCarthy and colleagues² propose a measured algorithm that should increase the precision and reproducibility of

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CENTRAL MESSAGE

There is a tremendous amount of science, precision, and calculated decision making within the practice of surgery. But something just seems to make outcomes better for some than for others—art!

repair in degenerative MR. To this aim, they made direct and echocardiographic measurements of the leaflet size and coaptation, and anteroposterior ring dimension in 1051 patients operated on by the senior surgeon (Dr McCarthy, referred to from here on as “the surgeon”) during a 13-year period, of whom 1026 (97.6%) had their valve repaired. Ten-year freedom from mitral reoperation was 99.7% and only 1.4% of patients had significant recurrent MR ($\geq 3+$). The authors concluded that “a simple, reproducible, measured algorithm for MVR provides excellent early and late results and is a useful adjunct to established surgical techniques.”

To me, the obvious conclusion is that the surgeon achieved excellent results before he developed and started using the algorithm and there is no evidence that its use will have a notable influence in the practice of any other surgeon. The authors tell us that residents and visitors have

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adopted the method, but there it is no information about their degree of success. Validation is of utmost importance in the development of any algorithm. Besides, the values of the measured parameters are already common knowledge to most surgeons with experience in MVRep; that is, the algorithm only repeats well-known concepts.

The precise measurements of the parameters included in the algorithm were made from the beginning of the experience. That certainly included part of the surgeon's learning curve, which I believe, never ends. Still, this surgeon persisted in not using artificial chordae and in preferring leaflet resection to preservation (resect vs respect), 2 modifications of the original Carpentier's concept that many of us, Carpentier included,³ have adopted in the meantime.

The authors state: "The concepts are based on basic mathematics," and "the algorithm was developed based on the science, not the art of mitral repair surgery." I believe that it is unfair to abandon the concept of art in surgery! In fact, even the measurements that the authors described as part of their algorithm require some art, and the widely recognized interobserver variation of transesophageal echocardiography performed by a cardiologist or the anesthetist and/or interpreted by a surgeon, undoubtedly makes it an art.

Art is also being able to predict what the measurements are going to tell us! Indeed, the authors state: "Not all measurements were recorded in every patient, usually just for surgical expediency." Also, "measurements of the coaptation length were discontinued once it became apparent that they were reliably within the target zone." Obviously, experience and art played a role here. Still, 32 patients (3.2%) required a second crossclamp, a small but significant percentage that indicates that there is no perfect method, however mathematical it may be. But I fully agree with the authors that "anything we can do in surgery to minimize variation and provide high reliability should be a welcome addition."

The most important component of the technique of MVRep is annuloplasty. Choosing the right ring and size is, in my view, crucial for a good result and I share with the authors the preference for a complete remodeling ring. In the current series, the surgeon essentially used the measured anterior leaflet height to determine the size of the annuloplasty device, but it is stated that "several makes, models, and sizes (median, 34 mm) of rings were implanted and we are not able to validate and reconcile different

manufacturers' reports of anteroposterior diameter." Finally, the authors concede, "There are minor variations to this algorithm. When the risk for SAM increases, a larger ring—1 or 2 sizes—may be chosen because this will move the coaptation point away from the septum. For patients with a posterior leaflet shorter than half the anterior leaflet, a ring 1 or 2 sizes smaller than the A2 length will provide better coaptation." We all knew this before the algorithm was now made public. Is this science or mathematics? I call it experience and it could be called art!

As a reviewer wrote during the editorial evaluation process: "These results are a benchmark for reference mitral surgery. The authors, however, have not addressed fully the reproducibility of these findings outside a reference surgeon's hands... How does one differentiate the effects of a high volume reference surgeon from that of the algorithm? Could it be that the results are excellent because it is Dr McCarthy (or any other renowned mitral master surgeon), as opposed to the algorithm and that similar excellent results in his hands would be achieved even if he adopted alternative approaches?"

I have no doubt about the art of this surgeon, but it is dangerous to compare this with other series. Patient cohorts are different from report to report and having 10% of patients lost to follow-up leaves out too many that could have had different outcomes. Also, the authors do not know the late cause of death; is it possible that some patients who died had significant recurrent MR? Besides, one must be cautious when talking of a 10-year freedom when the mean follow-up was 4.7 years.

There is a tremendous amount of science, precision, and calculated decision making within the practice of surgery. Still, there is something that just seems to make the outcomes better for some than for others... Perhaps this personalization of the trade is where the art comes from.⁴ Measurements come second!

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