was at that time quite sceptical about the applicability of his science to medical issues, as was Double, albeit for quite other reasons: The principal author of the report, Double, held that statistical thinking in terms of masses and groups undermined the notion of the patient’s individuality. Furthermore, the clinician’s specific art médical would be lost by non-medical scientists setting up fixed rules for doctors’ decisions about phenomena which were essentially variable. Furthermore, they would do so on the basis of probable results threatening to replace the certain knowledge derived from logical dogmatic systems and personal experience. In short, the clinician was not an empirical scientist but a humanitarian healer.6

Poisson criticised the simple cookbook arithmetic used by clinicians, but at the same time formulated reservations about the feasibility of mathematically sound therapeutic comparisons requiring 212 comparable patients in each group (according to his standards).

Civiale, who was considerably younger than the members of the Academy Commission, argued—as his 18th century British predecessors would have done and as would Louis—that only numerical results from pathological observations and all inclusive records of treatment successes and failures could avoid the fallacies of trusting memory alone. Double made no concessions to the numerists. He claimed that medical knowledge did not suffer from a lack of certitude because it could not meet the rigorous demands of ‘the calculus of probability’: Morgagni’s saying that ‘facts need not to be counted but need to be weighed’ (1761) was true and decisive. Giovanni Battista Morgagni was the 18th century ‘father’ of the anatomo-clinical method dear to Paris medicine in the early 19th century. Note that the mathematician Poisson and the clinician Double both used ‘calculus of probabilities’, but without understanding each other. While Poisson meant it in today’s sense, for Double it was a rhetorical expression of opposition to proper medical reasoning by inference from analogies.

Clearly this debate in the Academy of Sciences could neither satisfy Civiale, the urologist, nor the physician Louis and his followers. In 1837 a similar debate arose in the Academy of Medicine about the latter’s questioning, with numerical evidence, of the value of bloodletting, highly fashionable in the Paris of that time, to treat typhoid fever. And, of late, the debate is again with us, in the contested claims about evidence-based medicine.

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Commentary: Treatment of bladder stones and probabilistic reasoning in medicine: an 1835 account and its lessons for the present
Jan P Vandenbroucke

The 1835 paper ‘by Dr Civiale’ (1792–1867) that was translated by Angela Swaine Verdier is an historical gem.1 Many possible comments are possible about this paper. In the following, I have commented upon the text as such—without the benefit of any comparative study of similar papers, or reactions to this paper in the contemporary literature of the time, except for general historical and medical references that I had immediately at hand.

The 1835 paper ‘by Dr Civiale’ (1792–1867) that was translated by Angela Swaine Verdier is an historical gem.1 Many possible
In brief, the paper is a narrative commenting upon the work of Dr Civiale that was presented to the ‘Académie de Médecine’. The comments were made by four people who were members of the ‘Académie’ and they present the work of their colleague in the form of a review. The first part of this ‘review’ describes the numerical data presented by the author, with some remarks on its strengths and weaknesses. The essence of that first part is a comparison of the relative merit of the old treatment of lithotomy (i.e. ‘stone cutting’ via the perineal route) versus the new transurethral lithotripsy, for which new instruments were invented, among others by Dr Civiale. The second, interpretative part, goes beyond the paper and wonders how numerical data and ‘probabilistic reasoning’ can have a bearing upon the practice of medicine.

My remarks are grouped under several headings: first the disease and its treatment, which are an interesting object of historical epidemiology in itself, second the importance of the mode of presentation of this work in the ‘Académie de Médecine’, third the interesting remarks of the rapporteurs about the data, and fourth the part where viewpoints are expressed on the relation between probabilistic reasoning and clinical medicine.

Urinary Bladder Stones and their Treatment

Urinary bladder stones is one of those diseases that has disappeared mysteriously, at least from affluent industrialized countries. In the past urinary bladder stones were frequent in the West and they must have caused unbearable suffering as people were prepared to risk their lives in order to get relief. Lithotomy, or ‘stone cutting’ via the perineal route was the treatment of last recourse before the 1800s—a gruesome procedure with high mortality.

The history as well as the current epidemiology of urinary stones are captured in The Cambridge World History of Human Diseases in the chapter on urinary stones: ‘The major forms of urolithiasis consist of either upper tract stones within the kidneys or ureters (renal stones) or lower tract stones formed within the bladder. These two forms of urolithiasis have distinct differences in etiology, chemical composition, and epidemiological features, and should therefore be considered two separate diseases. Historical evidence has shown a striking increase in incidence of renal stone in the past 100 years. There has been a simultaneous decrease in bladder stone incidence…’

The cause of the decline of bladder stones is not known: an interplay of dietary factors (protein versus other nutrition), vitamins, fluid intake and infections is usually mentioned. Equally mysterious, is the rise of the renal stones which still has a socioeconomic gradient, being more prevalent in the higher classes in our society and more in men than in women. However, bladder stones continue to exist as an important medical problem in the developing world, often with the same epidemiology that they had a long time ago in ours. The Cambridge History again: ‘The large majority of bladder stones occur in young boys from rural or impoverished areas. In these regions, the disorder is known as endemic bladder stone disease’. Nowadays, the disease is most prevalent in Middle and Far Eastern countries, North Africa and some other African countries. A brief search in PubMed teaches us that most publications of the past 20 years come from Asia or Africa, with a predominance of publications about children.

Symptoms are pain and (super)infection. The pain of the acute renal colic, of renal stones, is known to be one of the more severe acute pain syndromes in medicine (women have described it as ‘worse than the acute phases of childbirth’). The pain of the bladder stone, however, is more or less constant, but can be almost equally excruciating. Samuel Pepys (1633–1703) was a sufferer and marked the anniversary of his surgery for the stone each year with a celebration; Benjamin Franklin (1706–1790) was a fellow sufferer and invented several devices to ease the pain.

The only possible definitive treatment up to the early 1800s was surgery indeed: lithotomy or ‘cutting the stone’. Dr Civiale’s 1835 paper is a comparative account of this ‘old’ mode of surgical removal through the perineal route, in comparison with the new ‘lithotripsy’ by a transurethral instrument. Cutting the stone was literally cutting through the skin, close to the anus into the bladder until the stone could be squeezed out. One 17th century stone sufferer was so much in pain that he applied the procedure upon himself, and was later painted, proudly showing the enormous stone and the knife that he applied to himself (Figure 1).

Early in the 1800s lithotripsy was suggested: to enter the bladder via the urethra with instruments that can grasp and then crush the stone in the bladder. The resulting ‘gravel’ is later urinated out. Civiale is held to be the inventor of the first lithotripsy instrument in 1818, but it did not function well (it drilled a hole through the stone) (Figure 2).

Others made improvements, upon which Civiale improved in turn, until a reasonably practical instrument was developed. This led not only to endless priority debates, but also to debates with the former ‘specialists’ of stone cutting in the ‘Académie’.

Figure 1 Painting of Jan de Dost who applied lithotomy to himself (Dutch, 17th century, courtesy of Prof. H Beukers, Leiden)
However much the lithotripters were initially derided, in the end they got the upper hand (after operating upon a famous surgeon), and they became members of the ‘Académie’ themselves.\(^5\)

One can only shudder at the thought of all these acts being performed without proper anaesthetics. Considerable folklore surrounded ‘stone cutting’ for centuries. Famous stone cutters travelled from town to town. One of them, named ‘Frère Jacques

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**Figure 2** Civiale’s instruments for lithotripsy.  
b. Bow type instrument of 1826 to remove stone by drilling. (Museum of Historical Medicine, Copenhagen, in Bennion, 1979.)  
c. Lithotripteur, operated by a bow. (From Collin Collection, in Murphy, 1972.) (Reprinted from Steinbock et al.\(^2\) with permission)
of Beaulieu (1651–1719), is also mentioned in Civiale’s paper—presumably the well-known children’s song refers to him. A glimpse of their results is given in one series by Frère Jacques that was unearthed: ‘Of 60 lithotomies performed from April to July 1697, 25 patients died; Mortality rate 42%’.4 No wonder they travelled from town to town!

There was, of course, little known about the results of lithotomy other than rumour and anecdote that amounted to publicity for the stone cutters. The publication of a true comparative series was an important event, particularly as Civiale had collected patients from centres all over Europe in the early 19th century. Mortality of lithotomy in the series presented by Dr Civiale was a staggering 1 in 5. Usually mortality was less in women, as it was easier to move the cut from the perineum up into the upper vagina—often resulting in lifelong vesico-vaginal urinary incontinence. For men, the discussion was between the medial cut (often through the prostate) and the lateral cut, closer to the leg. The high mortality in Civiale’s series was not unusual. The most renowned centre in Britain, at Norfolk and Norwich Hospital, published results obtained between 1772 and 1862 in *The Lancet*, and had a lithotomy mortality of 1 in 8, based on 910 reported cases. Mortality of lithotripsy, applied only to 17 people was nil (table republished in ref. 6).

The Presentation of the Work

The presentation of the work to the ‘Académie’ is an interesting form of peer review. Members of the ‘Académie’ were a group that perpetuated itself by co-optation of those judged to have outstanding scientific wisdom. Aspiring scientists presented their work to members of the ‘Académie’, who in turn passed it on—in the form of a commentary. One can only wonder how such papers must have gone back and forth before the content was agreed upon. Interestingly, the present paper was presented by Poisson, Dulong, Larrey and Double (the last one was rapporteur).

One name immediately strikes the epidemiological reader: Poisson (1781–1840). We still use the distribution that bears his name to calculate confidence intervals of counts, as in incidence rates. He was not only a great theoretical mathematician, but sought for practical applications of statistics. His first attempt at practical application was in assessing the correctness of legal decisions. He also became an endorser of numerical medicine, and thereby a supporter of the idea of ‘Médicine d’observation’ of Charles Pierre Alexandre Louis. The work by Civiale will and thereby a supporter of the idea of ‘Médicine d’observation’—after 1835—Double distanced himself more and more, and eventually became close to antagonistic.9 Given these names, the second part of the paper, the ‘interpretation’ of the use of probabilistic reasoning in medicine, is an important historical document. It represents the combined views of one of the most famous mathematicians and one of the most famous surgeons of 19th century France, with proper counterweight from the contemporary medical establishment.

Lithotomy versus Lithotripsy

In modern epidemiological language, Civiale’s paper might be termed a collaborative follow-up study of the outcome of a surgical procedure—or even a meta-analysis with individual patient data. Apparently, he collected series of patients all over Europe. It must have been an enormous work, and one yearns to know how he might have done it, how he selected the different centres, how he approached surgical colleagues, how he collected and tabulated the numbers, who paid him for doing so, who had the idea, and why. As to the ‘who and why’, the best guess is that he wanted to make his own point. As mentioned, he is credited with the invention of the first lithotriptic instrument, which he presented in a 1826 treatise ‘on lithotripsy’. This was the start of controversies, not only about this new procedure versus the older stone cutting, but also about the priority of the intervention.10 The presentation in the ‘Académie’, however, does not mention any of these mundane details. It presents few details of the investigation, and scarcely any numbers—presumably all of this is available in other publications. The ‘Académie’ devotes itself to high and pure interpretative thought. The interpreters are rather stern about the data: only conclusions from robust numbers with credible backgrounds are discussed, and the remainder is given short shrift. Although details are lacking, a few observations can be made.

It is amusing to read in 2001, in our modern era of ‘genomics’, that the first topic discussed was the heredity of bladder stones—with equivocal conclusions. The paper then proceeds to general causes, dietary and others, which remain almost as obscure as they are nowadays. Civiale’s series consisted predominately of children, and there is a glimpse from where in Europe he obtained data. The rapporteurs frowned upon conclusions without an appropriate denominator. They call attention to what we would call nowadays ‘popularity and referral bias’. The main modes of treatment are then discussed, with the 1-in-5 mortality of the lithotomy, versus a much lower mortality of the operation with the new transurethral instruments. It is argued that doctors themselves prefer the latter—an interesting type of argument that is, of course, a double-edged sword. In the 1950s doctors were also enthusiastic to prescribe thalidomide (as it was thought to be free of side effects), and quite recently it was shown that women physicians adopt hormonal replacement therapy more often than other women—a choice that might be rather ill-advised given the higher cardiovascular morbidity recently found in randomized trials.12 The rapporteurs stop short of a final verdict on the two modes of treatment. None is possible, as the patients on the two modes of treatment differ too much. However, they fall back on the old adage that it is not a question of absolute superiority, but a matter of relative indication. Given that relative indication (smaller stones, within reach, etc), lithotripsy has decidedly lesser mortality.
Probabilistic Reasoning in Medicine

Perhaps of greatest interest to today’s epidemiological reader, is the second part, where the rapporteurs discuss the role of probabilistic data in medicine. Again, there must have been reasons for doing so: a few years before the presentation of Dr Civiale’s paper, the ‘Société de Médecine d’Observation’ was founded in Paris in 1832—a society that is the forebear of our modern ‘Evidence Based Medicine’ movement. The great debates in the ‘Académie’ that led to the demise of the society happened between 1835 and 1837. Those debates centred on the meaning of numerical reasoning for the individual patient, and it was held that ‘il n’y a en médecine que des individus…’ As mentioned, in the course of the debate Double leaned more and more to the latter view. Presumably both the controversy around lithotripsy and the emerging discussion about the use of probabilistic reasoning in medicine were reasons for the lengthy discussion and the mixed group of rapporteurs in the 1835 ‘Académie’ report. A definite description of the function of this paper in contemporary medical literature would almost provide a PhD for a medical historian.

It is interesting to see how cautiously the arguments are made. A great point is made of the fact that probabilities can only be calculated about equal units and about large numbers: think about a large number of perfectly equal fair coins. However, humans are not equal and a physician who treats a patient has information that makes one patient different from the next. By necessity, statistics make people devoid of such characteristics. The usefulness of data from common medical practice is stressed, even if this will never tell the future of the individual patient that the physician is treating. The data offer a kind of ‘background’: they can yield general comparisons between modes of treatment, and thereby offer general guidelines for treatment. Whether the conclusions from particular data can be accepted is not just a matter of the data (because medical data are imperfect and do not yield probabilities) but also a matter of the logical reasoning behind the data. The rapporteurs mention the old adage of Morgagni: ‘Non numerandae sed perpendendae observationes’ (translated as ‘one should not count but rather weigh the facts’), which was slightly, but significantly changed for the motto of the ‘Société de Médecine d’Observation’ into ‘numerandae et perpendendae’. The rapporteurs clearly steered a most cautious course! One can only guess that this must be due to the discussions between Poisson the mathematician, Larrey the army surgeon, and Double who was distancing himself more and more from the Civiale-like way of doing medical research.

If I understand the rapporteurs well, they hold that judgement enters twice. The first judgement is whether to accept the verdict of the comparative data, which is as much a matter of logical reasoning about the investigation and the principles behind it, as of the data themselves. The second judgement is whether the overall verdict applies to a particular individual patient.

Such themes have been discussed by later writers. Greenwood, the first professor of Epidemiology at the London School of Hygiene wrote in his 1936 account of Pierre Charles Alexandre Louis and the ‘Société de Médecine d’Observation’: ‘He [the physician] is not an actuary advising a company to accept (or decline) “risks” but a physician called to help a sick man’. This is an echo, with a distance of a century, of what we read in the report of Civiale’s paper: ‘What result could be expected if one were to try to determine the time when Pierre is to die from general mortality tables?’

The debate continues today, it continues about the relative role of numerical, clinical and pathophysiological reasoning in the treatment of an individual patient. It also continues when thinking about the relative roles of numerical data and basic scientific insight in accepting arguments.

Conclusions

This important paper that was presented in the French ‘Académie de Médecine’ presumably played a role in two controversies: the right treatment of bladder stones, and the role of probabilistic reasoning in medicine. The first controversy was soon won by the lithotripteurs: the mortality of removing bladder stones by transurethral instruments was so much less that they triumphed and became members of the ‘Académie’ themselves. The second needed the passage of more than a century before we saw the rebirth of an interest in numerical reasoning in clinical medicine. Several of the themes of the second controversy still play a role in today’s debates about the relative usefulness of numerical, clinical and pathophysiological reasoning, and about the relative role of insight and numerical data in deciding which scientific proposition is true. Indeed, we might conclude that ‘The level of debate has not much advanced since Civiale and Double crossed swords…’—an observation that might be a starting point for self-reflection on all sides, to come to an even better mutual understanding.

References


