

# The rise and fall of uroscopy as a parable for the modern physician

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**ABSTRACT** As the first documented laboratory test in history, urinalysis, (or 'uroscopy' as it was historically referred to), was revered as the ultimate skill for physicians. The matula, in which the physician would pensively inspect his urine, would become an emblem of physician status and omniscience, a glass bladder that held the power to foretell a patient's future. It would also reveal much about how early physicians refined the scientific method, evolving their practice from that of speculation and magic and adopting more rigour in their analysis. However, the practice of uroscopy fell from grace as rogue physicians and charlatans began exploiting its reputation for dishonest gain and deception of patients. For this reason, the practice of uroscopy is intriguing – its rise and fall reflect the haphazard chase for a 'silver bullet' diagnostic tool which we would do well to remember today.

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## INTRODUCTION

For centuries, urine had been the only window into the body, especially as knowledge could not readily be gleaned from the frowned-upon act of dissection. It was also a 'liquid window' into the state of empirical medicine over the ages, with many advances in scientific rigour reflected in how urinalysis was performed and treated as a part of a physician's repertoire in patient diagnosis and treatment.<sup>1</sup> The history of urinalysis is interesting in that it also reveals how the doctor-patient relationship has developed with time.

Despite the usefulness of urine as a diagnostic tool, physicians with sham practices exploited the reverence that urinalysis was held with for their own gain and were chastised as 'Pisse Prophets' by 17th century English Physician Thomas Brian.<sup>2</sup>

## A BRIEF HISTORY OF UROSCOPY

Urinalysis was the first laboratory test documented in the history of medicine.<sup>2</sup> The first evidence of its practice was 6000 years ago by Mesopotamian physicians. It was ideal as a medium for diagnosis; as an unstable fluid, it could be physically and chemically analysed, and it would undergo change in disease states, making it a useful accompaniment to the physical examination.<sup>3</sup> The Ancient Egyptians were known to record the frequency and retention of urine in their patients and Babylonian and Sumerian physicians recorded their assessment of urine on clay tablets.<sup>1,4</sup> Around 400 BC, Hippocrates urged the importance of uroscopy in patient assessment

and documented the effects of food and drink on urine. He recognised that the presence of bubbles on the surface of urine was due to protein, indicative of kidney disease and potentially associated with urinary tract infections.<sup>5,6</sup> Sanskrit scriptures from India, dated 100 BC, showed how physicians classified urine into 20 categories based on shade and physical characteristics (such as cloudiness or sedimentation) and were the first to describe the sweet urine of diabetes mellitus;<sup>6</sup> this observation was only confirmed in 1776 by Matthew Dobson – almost a thousand years later.<sup>7</sup> In the middle of the 7th century, Theophilus Protospatharius recorded an experiment where the application of external heat precipitated urine and cloudiness in a sample.<sup>1</sup> This important finding was outlined in his influential book *De Urinus*, a leading title on uroscopy for centuries.<sup>8</sup> Although urine had become an exclusive diagnostic tool, reigning supreme over the arterial pulse, lone physicians began to voice their disquiet about its usefulness. It was Johannes Actuarius (1275–1328) who warned of the dangers of diagnosis based on urine alone.<sup>9</sup> His misgivings would be championed by Thomas Brian in the 17th century, who published *The Pisse Prophet* as an attack on the medical establishment's tolerance and promotion of uroscopy without sound evidence.<sup>10</sup>

## UROSCOPY AND THE BIRTH OF SCIENTIFIC PRACTICE

Early physicians realised the importance of urine and that the principles of science, observation and

experimentation, could be distilled in a urine vial. The physician had to employ the power of his senses: sight, smell and taste, to observe deviations from the norm in the patient's urine.<sup>10</sup> According to the English physician William Roberts: 'the amount of information concerning a urine which may be obtained through the unaided senses of smell and sight far exceeds both in precision and extent what is usually supposed.'<sup>10,11</sup>

Although some physicians began instituting scientific experimentation, and using objective evidence as their guide, this was not always a refined process. Indeed this new state of thinking was still in its infancy. For example, Frederick Dekkers (1644–1720) was the first to elicit proteinuria in 1664 but, despite this breakthrough, he did not recognise it for what it was and instead tasted it, believed he had made milk.<sup>10</sup>

Ismail Zayn al-Din Gorgani (1040–1136) was a Persian royal physician. He is interesting not only for the fact that his seminal works were produced when he was a septuagenarian, but because of a series of scientific observations he made about urine. He taught that urine should be collected in its full amount over 24 hours in a large clean vessel, and be kept away from the sun and heat as this would change its colour.

Gorgani's experiences showed physicians were still experimenting with scientific theory. He was adamant that urine should be stored in a vessel shaped in the form of a bladder, in the belief that a more accurate diagnosis can be reached if urine could conform to the vessel in the same way that it conformed in the body's natural bladder.<sup>1</sup> Despite this, his teaching was thought to be cutting edge at the time and his practices foreshadow what would be standard practice in today's advanced medical practice. He insisted that 'urine sent for examination should be that of the early morning, after a good sleep...it should be passed before partaking of certain foods changes the colour of the urine...' adding, '...one should not rely upon urine that has been passed during starvation, sorrow, weakness or sleeplessness or after coition, because conditions change its colour.'<sup>6</sup>

Proponents of the checklist in medicine, such as Atul Gawande, would approve of Gorgani's insistence in carrying out a systematic check of urine analysis. His seven-point checklist required examination of i) colour, ii) consistency, iii) transparency, iv) quantity, v) sediments, vi) odour, and vii) froth.<sup>1,6</sup>

Early physicians also came to understand the importance of urine concentration through a series of observations. They realised that urine output correlated with the amount of fluid ingested except for insensible losses (this observation being first recorded by Galen).<sup>10,12</sup> From this they deduced the concentration of urine from its colour, and created colour charts intended to represent different

conditions of health or disease. Nowadays we understand that the concentration of urine, measured by specific gravity or osmolality, can be a useful indicator of levels of hydration, shock, and pathological processes such as Addison's disease, renal disease, and other endocrine disorders including those of the hypothalamic-pituitary axis.

Hindu physicians showed great insight by not taking uroscopy as a sole means of diagnosis, but instead viewed it as part of a system of examination that embraced examination of the eyes, skin, pulse and even the patient's voice.<sup>1</sup> Like other civilizations that held uroscopy in reverence, Hindus developed elaborate classification systems for urine based on appearance, but unlike others were the first to comment on the sweet taste of urine in diabetes mellitus, describing it 'like the juice of cane sugar'. They also could identify the presence of blood in the urine by its 'salty tang'.<sup>1</sup>

The study of the history of uroscopy helps show how early physicians began toying with complex disease theories and including the state of urine as a diagnostic tool for disease processes beyond the urinary system. Although some of the deductive reasoning was questionable, they showed evidence of deep thinking. Actuarius's treatise on urine delved into far greater depths on the subtle shades of urine and their meaning.<sup>9</sup> He recommended the use of a graduated urine glass, which was split into 11 segments that would separate deposits, 'cloud' and 'scum'. The shades of colour would graduate along these levels and would be associated with distinct pathologies of the systems from which they came – at least in theory.

Ali ibn al-Abbas was a renowned Persian physician who hypothesised that yellow sediment in the urine was due to yellow bile from the hepatobiliary system, and if sediments were red, and were of long continuance, then this must have proceeded from inflammation of the liver.<sup>13</sup> Although not entirely true (the yellow colour of urine is indeed from urobilin derived from bilirubin, produced in the course of hepatic metabolism), Abbas' thoughts showed that at least a general hypothesis that dysfunction in internal organs might give rise to visible changes in the urine.

## THE MISUSE OF UROSCOPY AND ITS DEMISE

For a long time, the study of urine was still stubbornly stuck to humoral theory, which effectively all physicians before the 15th century used as a basis of their practice.<sup>10,14</sup> These physicians using the humoral doctrine could not usually differentiate between symptom and disease as they had no grasp of disease causing agents such as viruses or bacteria.<sup>10</sup> They believed instead that aberrations of urine were due to derangements in phlegm, bile and wind.



**FIGURE 1** Physician holding a matula with a patient's urine for inspection. Source: Avicenna's Canon. Images from the History of Medicine – NLM (public domain image)

Doctors would prognosticate over patients without seeing them by staring at their urine. Urine became 'the dumb messenger' between doctor and patient.<sup>10,15</sup> One trick physicians played was to inspect the urine of new patients and inform the patient that they had a grave illness – if their condition improved then it was due to the skill and virtue of the physician. If they became worse, or died, then the physician could not be at fault as he recognised the seriousness of the illness at the first visit.

Disquiet with uroscopy began to really emerge in the 17th century, a time of political, social and scientific upheaval.<sup>16</sup> English physician James Hart, in his book *The Arraignment of Urines* (1623), began exposing the fallacies of diagnosis made by quacks, 'prescribing divines', and even old women.<sup>10</sup> Following him, it was Thomas Brian (arguably the Ben Goldacre of his era) who rang the death knell for the unscientific approach to uroscopy. Declaring that 'urine is an harlot, or a liar' and reflecting on the problems of the medical practice of the day, he condemned laboratory methods without clinical observation and tried to convince physicians that 'it were fare better for the Physician to see his patient once than to view his urine twenty times.'<sup>15</sup> He was disheartened by what he saw as the need to manipulate patients and the way doctors were presenting themselves as holders of almost supernatural powers.

### REFLECTION OF THE DOCTOR-PATIENT RELATIONSHIP

Despite dubious practices, uroscopy can help us gain insight of something that is difficult to quantify, that is, the

doctor-patient interaction centuries ago. When used as part of a medical examination system, uroscopy required physicians to pay attention to their patients in every aspect of their life. Henry Daniel, a 14th century physician and friar, instructed doctors to 'slyly' make observations and deductions about the patient to aid diagnosis during home visits.<sup>17</sup> The doctor-patient relationship of time past was also not purely paternalistic. Patients were often responsible for the demand for uroscopy, at least in medieval Britain. Part of the problem was the lower cost of urine inspection compared to a home visit with full examination and history. Patients expected doctors to analyse the urine, otherwise the doctor would be thought to be 'troubled with the simples' or 'diseased in the brain'.<sup>16</sup> One could draw parallels with occasional current-day demands for blanket investigations such as CAT scanning of apparently healthy people.

Uroscopy patients could even be fairly deceitful. Al-saharavius (ca1085) cautioned the physician to beware patient trickery in what may have preceded our definition of Munchausen syndrome.<sup>1</sup> He advised taking careful account of the shade of urine, noting that the patient's urine may acquire a tinge if the patient takes saffron, cassia fistula or other drugs to deceive the physician. 'Such tricks' he adds 'are often practised upon water-doctors'. Avicenna even included a section in his *Canon* (Figure 1) to guide physicians on how to differentiate human urine from that of animals, warning his students '...liquids are sometimes brought by patients to test the skill of the physician.'<sup>1</sup>

## CONCLUSION

In Chaucer's *Canterbury Tales* (Figure 2), the physician is depicted as travelling on a pony with his urine basket slung on his shoulder, preying on the ignorance of the populace of whichever town he would visit, convincing them that he could diagnose all conditions and predict future events.<sup>18</sup> The infamy of uroscopy reached its height in the medieval and renaissance periods – claims were even made for its efficacy as a treatment (ingested or topical) for conditions such as warts, and alchemists also tried to extract gold from it.<sup>16</sup> As the West began entering the Age of Reason, anything to do with urine began to fall out of vogue and be condemned as medico-magical.

With the wisdom borrowed from hindsight, it is easy for the modern healthcare practitioner to scoff at the unscientific practices of the past. However, the lessons from the history of urine are as relevant today as ever. We have become increasingly reliant on a wide range of diagnostic investigations to solve both simple and complex clinical problems. In itself this is not a problem and can accelerate the process of diagnosis by eliminating confounding differentials – but the problem arises when they are used as a scatter gun alternative to founded clinical judgement. These tests should not relieve the physician from responsibility of careful observation and examination of the patient. Urine became the single authority on which to judge a patient's state of health.



**FIGURE 2** The Physician in the Ellesmere manuscript of Geoffrey Chaucer's *Canterbury Tales* holding a marla of urine. Source: <http://sunsite3.berkeley.edu/hehweb/EL26C9.html> (Public domain image)

The history of urine warns the modern day physician not to elevate another test (or a battery of them) to the same pedestal of infallibility.

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