Greco-Roman Stone Disease

5

Introduction

The Greeks and their Roman usurpers have left us a written legacy of intellectual knowledge that transcends all our modern sciences [1]. In medicine, the legacies of such immortal giants as Hippocrates, Diogenes, Heraclitus, Aristotle, Herophilus, and Erasistratus represent the foundations of modern medical ethos and practice. The Roman author Celsus and physician Galen have managed to leave a written legacy that allows historians to recreate medical wisdom from others, less familiar from the literature lost from the pyres of the Library of Alexandria [1]. This represents a review of classic medical writings in order to focus attention upon the "original" Western conceptions of urolithiasis that would ultimately influence the care and management of urolithiasis for more than two centuries.

> *Life is short, art is long, opportunity fugitive, experimenting dangerous, reasoning difficult: it is necessary not only to do oneself what is right, but also to be seconded by the patient, by those who attend him, by external circumstances* [2].
>
> —Hippocrates

The Aphorisms of Hippocrates represent a wealth of information about the ancient knowledge of medicine. Much has been written about the Hippocratic doctrine and specific diseases, such as urolithiasis. Hippocrates lived and wrote during the time of Pericles and rejected superstitious beliefs and attempted to make medicine more philosophical [3]. A review of classic Greek and Roman writings via widely available English translations serves a wealth of information. The Aphorisms of Hippocrates and much of his surviving writings are available in translated form even on the Internet [2]. Other sources can be more difficult to trace, but references can be backtracked by a wide variety of medical historical textbooks dedicated to this subject. These were the sources for all of the information about Greco-Roman urolithiasis in this treatise. In addition, any modern authors are also sought to supplement the information that could be culled in this fashion and to insure that no other primary sources were missed [4].

Stone Disease and Greco-Roman Theories

Hippocrates originally describes the shape and location of the kidneys at the back of the loins with concave sides against the large blood vessels [6]. It is attributed to Hippocrates that the paired nature of the kidneys resulted in the notion that disease that affects one equally affects the other. "*The light of the right eye with some disease affected, Is apt to make the left eye similarly infected*" [2]. Both Aristotle and Plinius believe that the kidney is a lobulated structure (from knowledge of bovine anatomy) and the "portions" of the kidney could be involved with disease while the other portions cope [5]. Galen professes that

M.E. Moran, *Urolithiasis: A Comprehensive History*, DOI 10.1007/978-1-4614-8196-6_5,

the kidneys are "hard and firm flesh" because the great looseness of the water that runs through them should not easily effect their flesh. Aristotle believes that the kidneys are given to animals by nature in order to stiffen and preserve the blood vessels and Galen groups the kidneys with the "glands." Hippocrates also pronounces the difference between renal and bladder stones. Hippocrates, Diocles, Praxagoras, and Galen all believe the kidneys attracted watery fluid by a hidden property and leads to a risk of stone formation, which formed from dietary excess [7]. Aristotle postulates that "*all things harden either by heat which dries the dampness, or by cold, which squeezes it out*." Two Greek physicians Rufus and Aretaeus both suggest that "*slimy earthy matter*" forms stones when kidneys are too cool, especially in older people with stones.

So stones themselves have a natural hardening tendency that is influenced by heat or cold. Hippocrates goes on to hypothesize that "gravel" does not occur in the kidneys until adulthood. Children, who often suffer from bladder stones, supposedly form and grow in the bladder, growing upon a kernel, or nucleus. Galen adds, "*the tough slime hardens by the heat of the kidneys and is baked into a stone. That the fire is indeed the cause, but that it does not act by its heat alone, but by drying and hardening the substance and because of other substances which it brings along with the flames*…. [8]"

Galen professes that children form stones because "they gobble their food and run, leap and play immediately after their meals resulting in the formation of thick water." Hippocrates suggests that a child becomes gravelly if it sucks bad milk and that the milk deteriorates if the nurse eats unwholesome food. Galen continues by suggesting that milk is thick and course by nature and extremely fit to produce stone [5]. And Aristotle questioned "*Why none of the animals but Man alone can become gravelly?* [5]" Galen proposes to answer this by depending upon the strength or weakness of the organ. According to Galen, this is the reason why grown people and aged persons are more often visited with stone in the bladder but children more frequently with renal stones.

Discussion

Beginning with Hippocrates, speculations regarding the pathophysiology of stone disease began in the West. Aristotle questions: "Why none of the animals but Man alone can become gravelly?" Stones are mentioned no fewer than in 24 passages of the Hippocratic dogma. Stone formation is discussed in 6 (25 %) of these aphorisms [4]. The Aristotelian perspective is maintained by Hippocrates (heat or cold). Adult versus pediatric and kidney versus bladder stones could be attributed to heat, and eventually Galen would reiterate this theme. It is also attributed to Galen for developing the theory of disease transference to a weaker organ…kidney versus bladder, for instance. Strabo reported a whole town with hot springs that hardened (further evidence of this process) [9].

Through the country of the Cicons
Flows a stream that is most strange;
He who drinks it, pays most dearly,
As it will not spare his life…
Is at once seen stark and stiffening,
Till it is as hard as marble.

The manner of "*growing the stone*" is explained by Galen; he adds, "*the tough slime hardens by the heat of the kidneys and is baked to a stone. But the fire is indeed the cause, but that it does not act by its heat alone, but by drying and hardening the substance*" [5]. Hippocrates (fourth Book of Diseases) adds that stones in young children have their origin in the milk. Red stones arise in the kidney (the color of flesh) all others from the bladder. Galen is noted to not believe this theory of the color origin of stones. Aretaeus states that "the tendency to develop stone of the kidneys is more difficult to prevent than the fecundity of the uterus" [5]. Hippocrates talks about the incidence of stones by saying "most between the ages of 14 and 42" and "women do not suffer so frequently of stone as men" [5]. Galen astutely notices that "too adipose [patient] can hardly be cured of defects in the kidneys." Plinius [2.5] concludes: "among all greatest pains which a man can suffer in his body, the trickling piss caused by stone has of old been deemed the

worst" [10]. All ancient Greek and Roman physicians and philosophers had advocated preventative measures. Ovid once penned [11]:

> *And let the illness not come in,*
> *But check it as it does begin*
> *For once it has obtained firm footing,*
> *It scorns the means for its uprooting.*

After the fall of classic Greece and before the rise of the Roman Empire, there arose in Alexandria a great medical school. Herophilus of Chalcedon became the first great anatomist and surgeon (~300 BC) and named the prostate [12]. Next came Erasistratus of Chios, also interested in anatomy and physiology (310–250 BC). Neither of these great minds left any evidence of an interest in stone disease. The decline of the Alexandrian school followed the deaths of these two great physicians, but their legacy was not entirely lost. Hegetor and Apollonius survived and kept the method alive, but again nothing on urolithiasis is mentioned [12]. Asclepiades of Bithynia and Schola Medicum taught medicine in the Alexandrian method. Rufus of Ephesus studied at Alexandria in 50 AD and practiced surgery and probably performed lithotomy. Also Marinus of Tyre, Quintus, Numisianus, Satyrus, and Pelops are some further notables but sadly left no legacy regarding stone disease [12]. Galen of Pergamum (129–199) first studied medicine under Satyrus then left to study with Pelops and then Numisianus until age 28. He then became surgeon to the gladiators, and in 161 he went to Rome with Marcus Aurelius as emperor [13]. Much of his philosophy on stones has been presented in this paper, but he also had some surgical experience. Heliodorus, Antyllus, and Oribasius all followed in the footsteps of Galen, but further interest in stone disease follows medicine in general into the Dark Ages [5]. Stone disease essentially did not rise above the hypotheses of Aristotle on the cause and perhaps peaked with Hippocrates on signs, symptoms, causes, and therapeutics. Galen certainly added some further insight but fell short of the experimentalists of Alexandria three centuries before him.

The ancient writers of medicine from Greece and Rome have left a rather significant historical legacy about the topic of urolithiasis. Not only did they document the signs and symptoms caused by bladder and kidney stones, they began to postulate hypotheses about the actual causes of this disease. Hippocrates concludes that between the ages of 14 and 42 are the most risky periods of life for stones, thus becoming the first investigator to study incidence as well as pathophysiology [5]. The Hellenistic legacy of these thinkers has persisted to our current era. We no longer follow the admonition to "not cut on those suffering from the stone," but we still seek epistemological truth. The great Greek philosopher Epicurus died from complications of stone disease, and it seems fitting to end with his own words… [14].

> *I write to you on this happy day which is the last of my life. The obstruction of my bladder, and the internal pains, have reached the extreme point, but there is marshaled against them the delight of my mind in thinking over our talks together. Take care of Metrodorus' children in a way worthy of your lifelong devotion to me and to philosophy.—Epicurus (341–270 BC)*

References

1. Osler W. The evolution of modern medicine. New Haven, CT: Yale University Press; 1921.
2. http://classics.mit.edu/Browse/browse-Hippocrates.html
3. Porter R. The greatest benefit to mankind. New York: Harper Collins; 1997.
4. Saito H. Descriptions of urinary stone in the Hippocratic collection. Jap J Urol. 2005;96(6):632–9.
5. Musitelli S. Selected passages on urological surgery from Hippocrates to the XVI century. Arnhem: Europaei Urologici Collegii; 2011.
6. Herr H. 'Cutting for the stone': the ancient art of lithotomy. BJU Int. 2008;2:1464.
7. Singer C. A short history of anatomy and physiology from Greeks to Harvey. New York: Dover; 1957.
8. http://classics.mit.edu/Browse/browse-Galen.html
9. http://classics.mit.edu/Browse/browse-Strabo.html
10. Beagon M (translator). The elder Pliny on the human animal: natural history, Book 7. Oxford: Oxford University Press; 2005.
11. Hardie P, editor. The Cambridge companion to Ovid. Cambridge: Cambridge University Press; 2002.
12. von Staden H. Herophilus, the Art of Medicine in Early Alexandria. Cambridge University Press, Cambridge, 1989.
13. Mattern S. The prince of medicine. Galen in the Roman Empire. Oxford: Oxford University Press 2013.
14. O'Connor E. The essential Epicurus. Buffalo, NY: Prometheus Books; 1993.