

# Investigating the pathophysiology and dissolution of kidney stones from a clinical and pharmacological perspective

Lampton School

Ayaan

## Abstract

Kidney stones are an ever-present disease, one of the oldest known to medicine, with its prevalence in society increasing more and more as a result of other complications such as diabetes which can cause nephrolithiasis. In fact, during the golden age of Islam (roughly 1000 years ago), physicians prescribed poppy for gall bladder stones and kidney stones. The most common types of kidney stones are, Calcium oxalate crystals (Account for 70% of kidney stones), Calcium Phosphate stones (10%), Uric acid crystals (10%) and struvite crystals (10%)

## Research aims

To see the effects of an agent such as Hydroxycitrate or Potassium citrate on the dissolution of Calcium oxalate crystals, as HCA and CA inhibit crystallisation formation, and if possible, record the changes when allopurinol is added to uric acid crystals.

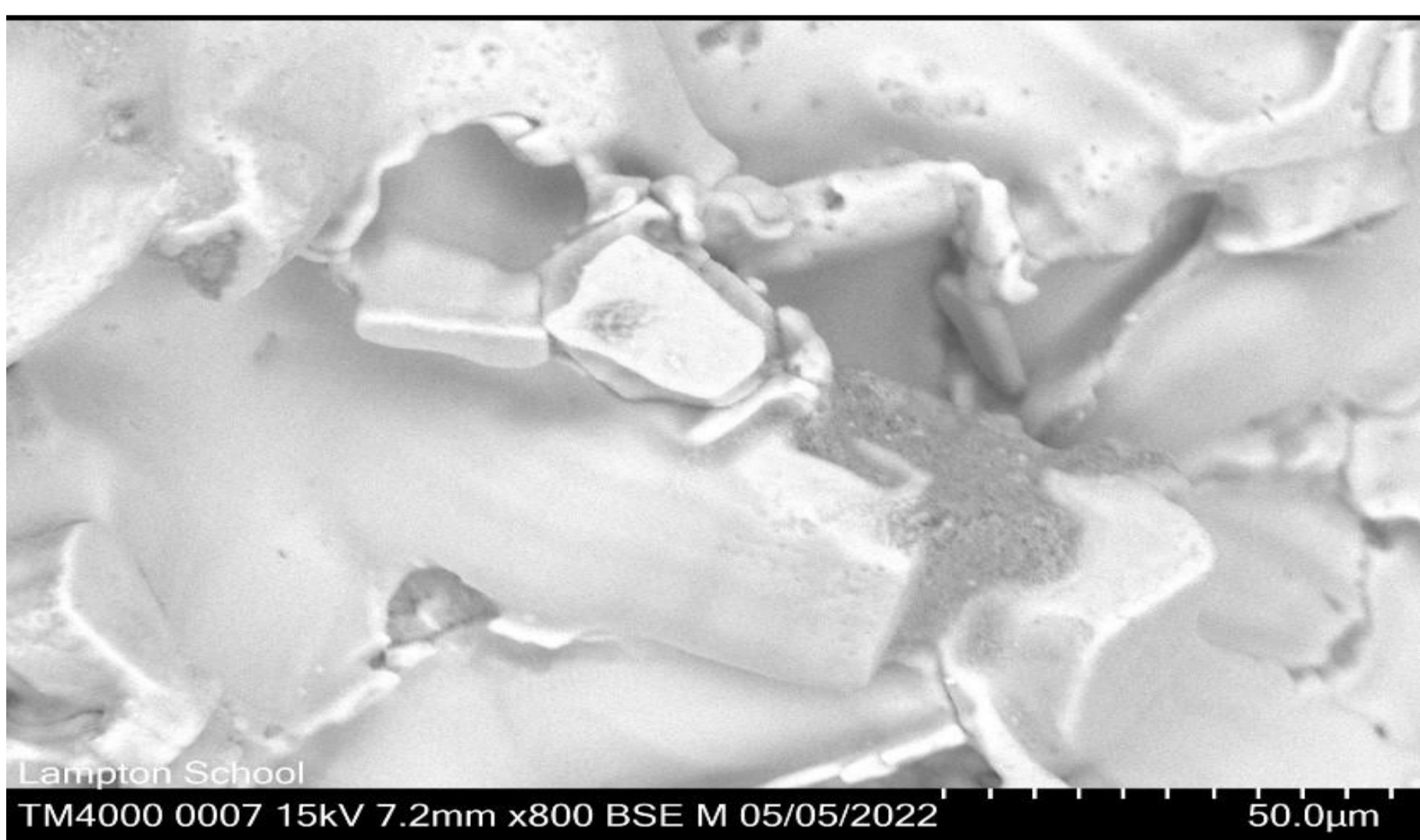


Figure 1: Calcium Oxalate crystals,

## Results

As the photomicrographs show, Kidney stones which are formed from calcium oxalate crystals, form Jagged, Hard edges, which cause the pain in patients, and the Potassium Citrate helps to smooth out the micro and macrostructure of the Stones, as Figures 2 and 5 show that the stones have a more planar surface, with more contour than the stones pre treatment, meaning that they will cause less pain in patients, allowing for an easier passing of the Stones



Figure 3 Calcium oxalate crystals pre treatment, x50 Magnification



Figure 4 Calcium oxalate crystals pre treatment, x200 Magnification

## Experimental method

### For Calcium Oxalate crystals:

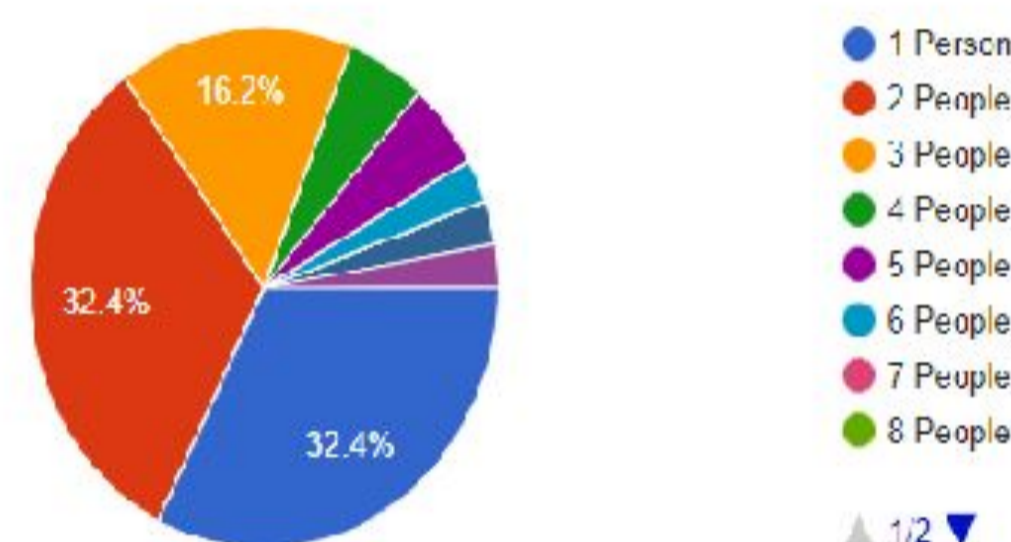
To make 10g of synthetic kidney stones, dissolve 8.66g of  $\text{CaCl}_2$  in 20 ml of water, and 10.46g of Sodium oxalate in 20 ml of water, mix the two to form a precipitate

### For Calcium phosphate crystals:

15.87g of  $\text{Ca}(\text{NO}_3)_2$  in 20 ml of water  
10.57g of  $(\text{Na}_3\text{PO}_4)$  in 20 ml of water, mix the two to form a precipitate. Then observe these two precipitates under the SEM, Following this, I dissolved Potassium citrate in both precipitates.

## Results from the Survey regarding the prevalence of Kidney stones.

The results from the survey show that kidney stones are quite common in the population, thus, treatment for stones should be more accessible and the public should be informed on what best advice to give to others who are suffering from kidney stones.



### Results from Google form

Responses to “How many people do you know that have suffered from kidney stones, or currently have kidney stones?”, showing that the prevalence of kidney stones are high, and therefore our treatment of potassium citrate should be more accessible to the population

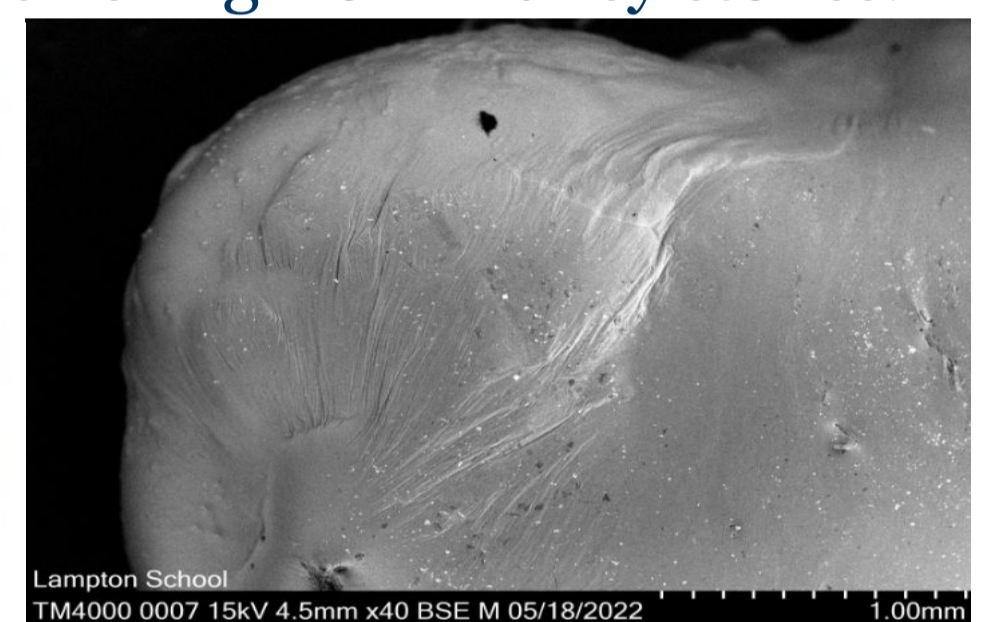


Figure 2

Kidney stone, following the addition of potassium citrate, showing a smooth much more rounded stone with less edges, thereby causing less pain for the patient

## Analysis & conclusions

All of the presented evidence [in the form of photomicrographs] supports the case that minerals such as Potassium citrate should be given to patients with Kidney stones in order to help aid patients in passing their stones. Furthermore, healthcare professionals may wish to advise patients to have a diet high in Citrate or citric acid, hence, patients could incorporate foods such as Lemon juice, Orange juice or pomegranate juice which are high in Potassium citrate.

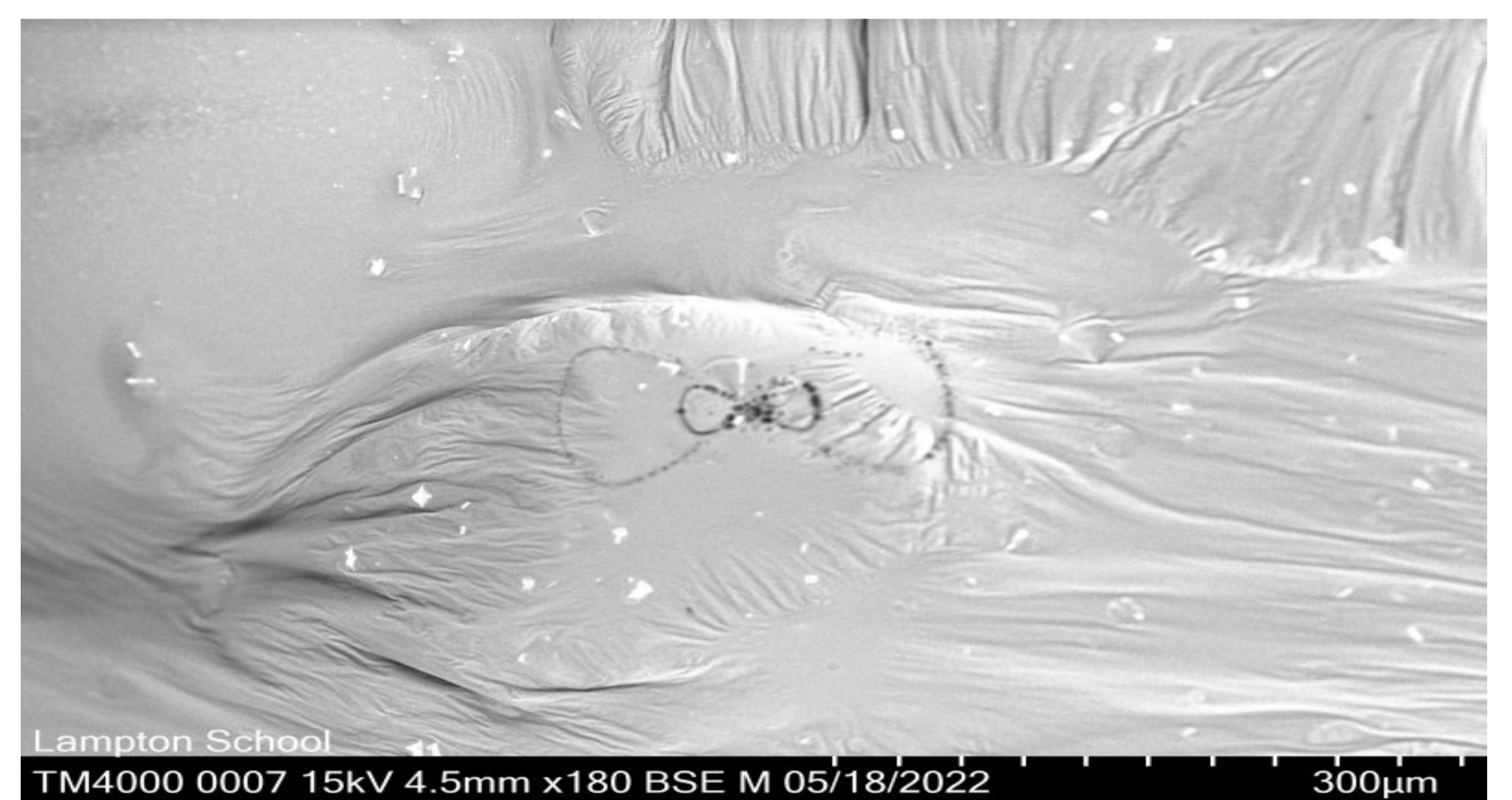


Figure 5

The “Bow Tie”, Photomicrograph showing how the addition of potassium citrate on calcium oxalate crystals smooths out the texture of the stones



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