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A Comprehensive Review on Kidney, Gall Bladder & Abdominal Stones Disease and their Remediation

M. K. Gupta¹, Alpana Gupta²

Research Associate, Central Pollution Control Board, Delhi, India¹

Principle, Mahi Girls College, Pratapgarh, Rajasthan, India²

ABSTRACT: The Chitrakoot region is included in the District Chitrakoot of Uttar Pradesh and the District Satna of Madhya Pradesh. Chitrakoot district in Uttar Pradesh was created on 4 September 1998. Parameters investigated were hardness, calcium carbonate, calcium bicarbonate and alkalinity. The results were compared with human health prescribed by WHO. The revealed of study showed that the human urinary system will be not healthy due to drink without filtration of water. Moreover, the results of this study showed that calcium oxide was a major ingredient of the abdominal stones. The calcium bicarbonate, calcium oxalate and phosphate were present in high amount in water of Chitrakoot region.

Based on earlier studies, it was observed that the alkalinity, total hardness, calcium carbonate and heavy metals i.e. Lead and Copper were present in high amount in water of Chitrakoot region. Due to heavy discharge of harmful and deleterious substances like of soap and detergents in river, people exposed to above contaminated drinking water were prone to health hazards of heavy metals toxicity. The drinking of this ground water may be changed the biological and physical characteristics of Kidney, Gall bladder & Abdominal. It is suggested to all peoples that drinking water needs to be filtered before use. The drinking water should be supplied after proper treatment by Municipal Corporation.

KEYWORDS: Kidney, Gall bladder, Abdominal stone, Calcium hardness, Water hardness, remediation

I. INTRODUCTION

of persons suffers from kidney stone, gall bladder stone and ureteric stone. Stone disease is getting increasing trend due to changes in living conditions *i.e.* drinking of hard water and malnutrition. More than half a million people are affected from kidney and gall bladder stone annually in United States and more than 50,000 people in Canada. Canada endures surgical treatment to remove their gall bladder because of gall bladder stone. About 80 % of all the gall stones has evidence for no symptoms and may continue for years (Ricardo and Manoj, 2009).

Chaurasiya S. and Gupta R. (2016) found the value of alkalinity in range from 272.16 to 404.0 mg/l, total hardness in the range from 200.56 mg/l to 352.42 mg/l; and calcium carbonate in the range of 121.66 mg/l to 277.70 mg/l. The WHO recommends the alkalinity, total hardness and calcium hardness is 200, 300 and 75 respectively. Gupta et.al., (2021) reported that hardness was found in the range of 197-261 mg/l.

Ten different underground drinking water samples was assessed and found that drinking water was excessively contaminated with lead metal at 3 sites. While Zn and Cu were present in traces at all the selected sites. (Gupta et.al., 2014).

Gupta et.al., (2012) observed that the concentration of Pb and Cu in water of the Bawalis was found in the range of 0.1 to 2.146; and nd to 0.07 mg/L respectively. The concentration of Zn, Cr and Fe was found in the range of 0.623 to 2.142, nd to 0.07 and 0.036 to 0.097 mg/L respectively. Thus the concentration of Pb and Cu was found above the permissible limit and concentration of Zn, Cr and Fe was found within the permissible limit.

Ashok et al. (2003) and Al-Kinani et al. (1984) used EDXRF to measure Br, Cu, Fe, Pb, and Zn present in gallstones. The XRF technique together with neutron activation (NA), proton induced X-ray emission (PIXE) to analyze minor and trace elements such as Ca, P, S, Al, Mn, Cu, and I in gallstone and bile samples. The distribution and form of Ca was examined qualitatively by scanning-electron microprobe and IR spectroscopy.

Bielecka et. Al., (2014) told the analysis of samples was performed by application of the total reflection X-ray fluorescence, wavelength dispersive X-ray fluorescence and X-ray powder diffraction methods. Various elements i.e. O, Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, Mn, Fe, Ni, Cu, Zn, Se, Br, Rb, Sr, Zr, I, Ba, and Pb had been analyzed with X-ray fluorescence methods.

(Weerakoon et.al., 2015) told the data of 102 patients were analyzed. They observed that calcium bilirubinate, calcium carbonate and calcium phosphate were the commonest calcium salts identified in pigment gallstones and core of mixed cholesterol gallstones.

In human body the urinary system plays an important role. The urinary system consists of the following components organs:

- The Kidneys
- The Ureteric
- Gall bladder

The function of urinary system is affected due to formation of stone, prostrate, etc. here we have to analyses how different types of stones put barrier in the urinary system but it is essential to get acquainted with the prime organs related to this.

Kidneys

The kidneys are two bean shaped organs situated in the posterior part of the abdomen, one on each side of the vertebral column, behind the peritoneum. They lie at the level of the twelfth thoracic to the third lumbar vertebrae, though the right kidney is usually slightly lower than the left because of its relationship to the liver. Each kidney is about 11cm long, 6cm wide and 3 cm thick and is embedded in a bed of fat called the perirenal fat. The medial border of each kidney is concave in the centre. This area is called the hilus and it is the point at which the blood vessels, nerves and ureteric enter or leave the kidney (**Fig. 1**).

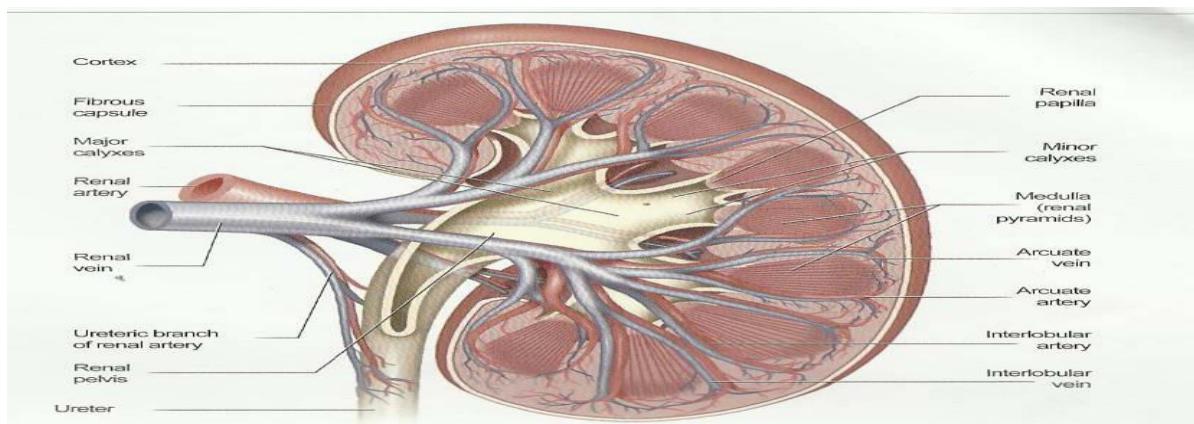


Fig. 1. Structure of Kidney

Kidneys Stones

A kidney stone is a hard crystal mass that develops from crystals or small particles that dislodge from the urine and build up inside the kidney. Kidney stones vary in size and can be as small as a grain of sand, or as large as a table tennis ball. Stones may appear in any part of the urinary system.

Stone formation inside the gallbladder and kidney are serious and painful diseases which affect a significant percentage of the population worldwide (Afdhal 2004; Berhoft et al. 1984; Trotman et al. 1974). Many theories had been put forward to explain the mechanism of stone formation and their growth. Over the last few years, the prime aim of stone-based biomedical research has been the measurement of the atomic and molecular composition of the stone and correlation of this information to patient abnormalities (Rao et al. 2011; Ramaswamy et al. 2015).

Srivastava et al., (2014) told that four kidney stones were collected from patients being treated in the Advance Urology Centre of PGIMR, Chandigarh were characterized using instrumental neutron activation analysis (INAA), energy dispersive X-ray fluorescence (EDXRF) and X-ray diffraction (XRD) techniques. They found that the concentrations of trace elements in general were found to be higher in calcium oxalate stones and positive correlation was observed in the concentrations of Ca with Sr and Zn.

Kidney Stone Formation

Several factors contribute to kidney stone formation:

- Recurrent urinary tract infections
- Drinking too little fluid
- Blockage of the urinary tract
- Consuming too much calcium and vitamin C in the diet
- Taking medications like calcium-based antacids
- Metabolic disorders such as hyperthyroidism
- Gout and chronic bowel inflammation

Kidney Stones Causes

- Kidney stones range in size from microscopic to stones the size of potatoes, with a smooth or jagged texture
- They can form anywhere in the kidneys, ureters or the bladder
- 80% of kidney stones contain calcium
- Some contain calcium phosphate - the material that makes bones hard

- Uric acid can be present (the chemical that causes gout)
- Cystine (one of the amino acids that form proteins) is a rare cause
- ‘Staghorn’ calculi form inside the drainage canals (pelvis) of the kidney. They are composed of ‘Struvite’, a mixture of ammonium, calcium and phosphate. This type is often caused by infection. It can cause a progressive decline in kidney function.

Common Symptoms

Kidney stones can cause intense pain and blockage as they pass downwards. Any or some of the following symptoms are noticed:

- Severe loin pain that comes and goes (in the back or side between the pelvis and lower rib). This is known as renal colic.
- The pain can move down into the groin or genitals nausea difficulty in passing urine any blockage could cause a loss of kidney function
- Visible or microscopic traces of blood in the urine symptoms are not always present - Staghorn stones (see above) do not always cause problems -at first Infection of the kidneys is more likely if stones are present.

Ureteric

Ureterics are small muscular tubes, approximately 25 cm long, which carry urine from the renal pelvis to the urinary bladder. Each ureteric descends from the renal pelvis along the posterior abdominal wall and connects to the bladder on the posterior inferior surface. The ureteric wall comprises three layers:

- Outer fibrous coat comprises fibrous connective tissue
- Middle muscular coat comprises outer longitudinal and inner circular smooth muscle
- Inner mucosa comprises transitional epithelium

The inner layer continues with the lining of renal pelvis and bladder. Muscular coat layer helps in peristalsis to propel urine.

Chemistry of Urinary Stones

The chemical composition of urinary stones in children is similar to those found in adults. About one-half are calcium oxalate, calcium phosphate account for 15–25%, while 10–15% is mixed (calcium oxalate and calcium phosphate). The others are struvite (magnesium ammonium, phosphate) 15–30%, cystine 6–10%, and uric acid 2–10%.

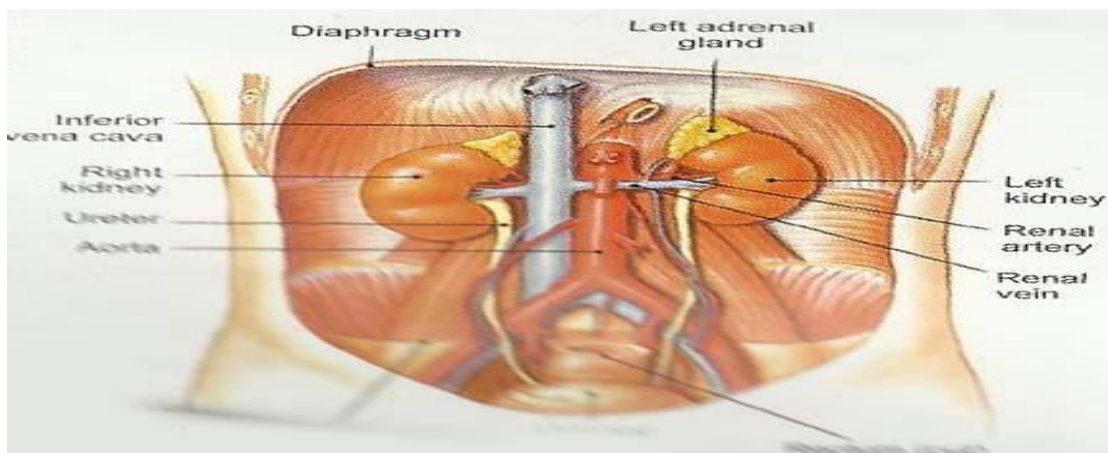


Fig. 2. Structure of Urinary Bladder

Gall Bladder

The components of the biliary system are:

- The right and left hepatic ducts from the liver which unite to form the common hepatic duct
- The gall bladder, which acts as a reservoir for bile
- The cystic duct, leading from the gall bladder
- The bile duct formed by the junction of the common hepatic and cystic ducts.
- The gall bladder is a pear-shaped organ situated on the under surface of the right lobe of the liver. From it the cystic duct, which is about 3-4 cm long, passes backwards and downwards to join the common hepatic duct and together they form the bile duct (Fig. 3). If the bile secreted by the liver is not required immediately for digestion it passes up the cystic duct into the gall bladder where it is both stored and concentrated. The capacity of the gall bladder is between 30 and 60 ml but, because of its capacity to absorb water, the bile it contains becomes increasingly concentrated.

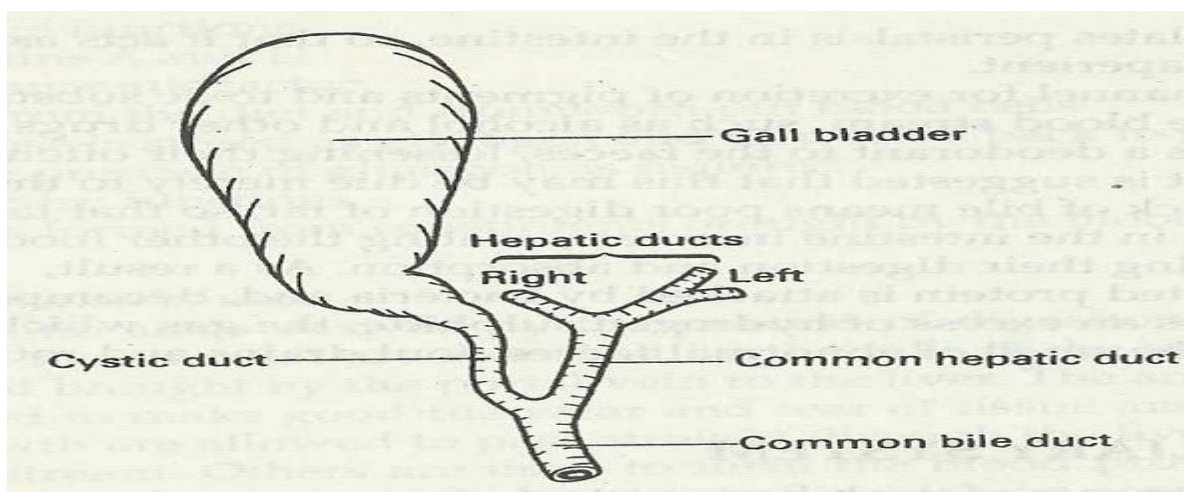


Fig. 3. Structure of Gall Bladder

Functions of the Gall Bladder

The gall bladder is a reservoir for bile. During fasting resistance to flow through the sphincter is high and bile excreted by the liver is diverted to the gall bladder. After feeding the resistance to flow through the sphincter of oddi is reduced the gall bladder contracts and the bile enter the duodenum. There motor responses of the biliary tract are in part affected by the hormone cholecystokinin. The second main function of the gall bladder is concentration of bile by active absorption of water, sodium chloride and bicarbonate by the mucous membrane of the gall bladder. The hepatic bile which enters the gall bladder becomes concentration 5-10 times, with a corresponding increase in the proportion of bile salts, bile pigments cholesterol and calcium.

The third function of the gall bladder is the secretion of mucus approximately 20ml is produced per day. With total obstruction at the cystic duct in a healthy gall bladder, a mucocele develops on account of this function of the mucosa of the gall bladder.

Gall Bladder Stone

Gall bladder stones are the most common biliary pathology. In 1992 it was estimated that 10-15% of the adult population in the USA had Gall stones (20 million peoples) and that 600,000 underwent cholecystectomy. The vashmajority of subjects (more than 85%) is a symptomatic, and when such patients are followed, between 1% and 40C per year will develop biliary symptoms. The strong recommendation for pations with asmpotomatic stones is expectant



management. Few patients die to their Gall stones. Gall stones are classified into cholesterol, black pigment and brown pigments stones cholesterol stones are the most common and contain 51-99% pure cholesterol black pigment stones are largely composed of an is soluble bilirubin pigment polymer mixed with calcium phosphate and carbonate. Brown pigment stones contain calcium bilirubinate calcium palmitate and calcium stearate as well as cholesterol brown stones are rare in the gall bladder they form in the bile duct and are related to bile stasis and infected bile.

Gallstones (pebble-like substances that develop inside the human gallbladder) are one of the most painful biliary tract diseases in adults with a particularly high incidence in India. Gallstones form when bile stored in the gallbladder hardens into pieces of stone-like material. Bile is a bitter yellow or green fluid secreted by liver hepatocytes of most vertebrates and then stored in the gallbladder and used in the digestion of fats. Upon contraction, the gallbladder pushes bile into the common bile duct which then carries it to the small intestine, where it carries out its fat digestion role. The composition of bile includes water, cholesterol, fats, bile salts, proteins, and bilirubin (Cox et al. 2018; Reshetnyak 2012).

Gallstones are hard chemical particles that form and develop inside the gallbladder after a complex series of events involving bile supersaturation, nucleation and initiation, and stone enlargement by accretion. Formation of gallstones is initiated by biliary stasis, infection, and/or mucin and their size increases nearly 3 mm per year quickly reaching up to a few centimeters in diameter. Gallstones occur in nearly 95% of patients with cholecystitis (Swobodnik et al. 1990). The chemical constituents of gallstones are complex and vary in a stone-to-stone manner depending upon the dietary habits of patients, their geographical region along with many more factors (Singh et al. 2009a).

Cox et.al., (2018) observed that the comprehensive management of all aspects of gallstone disease, from the epidemiology and pathogenesis to the complex management approaches required for some patients. They suggested that the main emphasis was placed on effective diagnosis and treatment, making extensive use of practical case-based material while reviewing the guidelines in a multi-disciplinary manner. It was an essential read for all clinicians involved in managing patients with gallstone disease.

Chandran et.al. (2007) stated that the biliary calculi were collected from 200 gallstone patients were divided into 3 groups based on their colour: cholesterol calculi, mixed calculi and pigment calculi. Out of the 200 stones collected, the incidence of gallstone was higher in age group 41-50 yrs. They found that the size (B and L) of cholesterol calculi was in the range 0.2-2.4 cm and 0.4- 3.2 cm with an average of 0.97 cm and 1.50 cm, while for mixed calculi it was in the range 0.1-2.5 cm and 0.1-3.0 cm with an average of 0.6 cm and 0.93 cm and for pigment calculi it was 0.1-1.9 cm and 0.2-2.5 cm with an average of 0.69 cm and 1.01 cm.

The herbal medicine systems in our health care. Lets us hope that in future natural products like Pashanbheda, Alternantherasessalis and Aerva spp. Bergenia ligulata syn. Saxifregaligulata is being widely accepted under this name. Chemical efficiency of Bergenia ligulata is dissolving the urinary stones fully justifies the use of various names attributed to it, viz., Pashanbheda, Pashana, Asmaribheda, Ashmabhid, Ashmabhed, Nagabhid, Upalbheda, Parwatbheda and Shilabhed will be competing modern medicines with added advantages of more safety and lower costs (Alok et.al., 2013).

II. RESULTS AND DISCUSSIONS

The application of XRF spectrometry, X-Ray fluorescence spectroscopy and dispersive mode (ED-XRF) is used to analyze gallstones and in stone diseases. Various elements i.e. O, Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, Mn, Fe, Ni, Cu, Zn, Se, Br, Rb, Sr, Zr, I, Ba, and Pb may be analyzed with the help of X-ray fluorescence methods.

Calcium oxide is a major ingredient of the abdominal stones so it can be concluded that calcium hardness is the main cause information of such stones. Based on earlier studies, it is found that the alkalinity, total hardness, calcium



carbonate and heavy metals i.e. Lead, Copper are present in high amount in water of Chitrakoot region. The concentration of phosphate is also in considerable amount in the water of Chitrakoot region. Actually peoples are used drinking water without any pretreatment owing to their economic limitations. High extent of loss on ignition value in characterization of above stones is an indication for presence of high extent of oxalate in the patients. The oxalate may get the path in patients through their food chain.

III. CONCLUSIONS

We concluded that calcium hardness is the main cause information of such stones. Thus calcium bicarbonate present in high amount in water of Chitrakoot region. The concentration of phosphate is also in considerable amount in the water of this region. The calcium oxalate may get the path in patients through their food chain. Based on earlier studies, it is observed that the alkalinity, total hardness, calcium carbonate and heavy metals i.e. Lead and Copper are present in high amount in water of Chitrakoot region. People exposed to above contaminated drinking water are prone to health hazards of heavy metals toxicity, so the water quality management is necessary. Actually peoples are used drinking water without any pretreatment owing to their economic limitations. The drinking of this ground water may be changed the biological and physical characteristics of Kidney, Gall bladder & Abdominal.

It was noticed that chemical efficiency of *Bergenia ligulata* is dissolving the urinary stones fully justifies the use of various names attributed to it, viz., Pashanbheda, Pashana, Asmaribheda, Ashmabhid, Ashmabhed, Nagabhid, Upalbheda, Parwatbheda and Shilabhed will be competing modern medicines with added advantages of more safety and lower costs.

It is suggested to all peoples that drinking water needs to be filtered before use. The drinking water should be supplied after proper treatment by Municipal Corporation.

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